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THE THIRD INTERNATIONAL ZOÖLOGICAL CONGRESS, LEYDEN, SEPT. 16–21, 1895.

THE International Zoölogical Congress was organized at Paris in 1889 and the second meeting was held at Moscow in 1892. Neither of these Congresses was conspicuously successful in attaining a truly international character. The third Congress, however, which met at Leyden, September 16–21 of the present year, was not only brilliantly successful from the scientific point of view, but was also thoroughly international in the best sense of the word, a result which the Committee of Organization took the greatest pains to secure. The whole number of members registered was 232, representing 22 nations and colonies. Of course, these numbers were not equally distributed, Holland having 64 and France 56 of the entire number. Of much more importance than mere numbers in giving this international character was the distinguished position of very many of the delegates, most of the countries being represented by their foremost zoölogists, and the quality of the papers presented was unusually high. The arrangements for the comfort and convenience of the members, for the meetings and excursions, were in all respects excellent, and the Committee of Organization, MM. Hubrecht, Jentink, Hoek and Horst, as well as the local committees, acquitted themselves of their difficult task to the admiration of all the visitors. Upon this subject there was entire unanimity of opinion, and none who had the privilege of attending this Congress are at all likely to forget the delightful and stimulating experience.

On Sunday evening, September 15th, an informal gathering of the members of the Congress was held in the summer building of the 'Amicitia' Club, which, like the other clubs of Leyden, was hospitably thrown open to the delegates. This occasion was principally remarkable for the graceful speech of welcome in three languages, made by Prof. A. A. W. Hubrecht, President of the Netherlands Zoölogical Society, under the auspices of which the Congress was held. This speech, which was warmly applauded, is given in full:

MESDAMES, MESSIEURS ET CHERS COLLÈGUES!

C'est avec une joie bien sincère que je prends la parole ce soir pour vous remercier au nom de la Société Néerlandaise de Zoologie de vous être rendus à la bonne ville de Leyde afin d'y constituer un troisième Congrès International de Zoologie, qui a été précédé par les seuls Congrès de Moscou et de Paris.

Nous avons beaucoup apprécié la décision qu'a prise le Congrès de Moscou, il y a trois ans, de conférer l'honneur de la troisième session à la Hollande.

Aujourd'hui nous nous félécitons de nous voir entourés d'une réunion si nombreuse de savants des divers pays d'Europe, d'Asie et d'Amérique, voire même d'Afrique, qui ont bien voulu répondre à notre appel. Nous tous, nous aurons l'occasion de constater qu'une semaine, comme celle qui nous attend, va porter des fruits utiles à la science en même temps qu'elle va tisser de nouveaux liens d'amitié entre ses adeptes.

Ce soir nous ne sommes pas encore le Congrès International, ce soir nous ne sommes que des molécules libres qui ne demandent qu'à se combiner au plus vîte en un produit d'un ordre plus élevé et d'une utilité incontestable, sous la direction du chimiste si compétent, notre collègue le Dr. Jentink.

Profitons donc de la liberté dont nous iouissons encore ce soir pour ne pas le consacrer à des discussions scientifiques, mais uniquement à nouer et à renouer des liens personnels d'amitié, ce qui sans aucun doute constitue un des avantages les plus précieux de ces réunions internationales.

Es giebt aber *einen* Punkt über welchen man sich in diesen internationalen Zusammenkunften hinweg zu setzen wissen muss, nl. eine all zu grosse Vorliebe und eine zu sorgsame Pflege seiner Muttersprache. Ein jeder von uns wird es sich gefallen lassen müssen, dass er seine Fachgenossen aus aller Herren Ländern, sowohl aus Höflichkeits- wie aus Bequemlichkeitsgründen in ihrer anstatt in seiner eigenen Sprache anzureden haben wird und wir werden uns freuen, wenn ein uns interessirender Vortrag eines ausländischen Collegen uns zu gleicher Zeit die Gelegenheit verschafft unsere Sprachkentnisse zu erweitern. Die Niederländische Zoologische Gesellschaft, welche sich für ihre Einladungen zum Congress von drei modernen Sprachen bedient hat, hofft, dass auch die Mitglieder sich innerhalb des Rahmens dieser drei Sprachen einzuzwingen wissen werden. Soviel ich weiss werden wir Holländer den Herren nicht mit einer einzigen auf Holländisch vorzutragenden Mittheilung das Leben sauer machen.

Dem Thurmbau unserer Wissenschaft wird es zu Gute kommen, wenn wir die Sprachverwirrung—die traditionell am Ende einzutreten verspräche—gleich im Anfang in beherrschbarre Bahnen zu lenken wissen.

And so, to complete the triology of languages which I have recommended to your consideration, I ought to set a good example and to close these few words of welcome to the members of the Congress that is to be, in the language that was spoken by Newton, by Harvey, by Darwin and by Huxley.

This language is undeniably spreading all over the globe with greater rapidity than any other, and has got a very firm hold on

the five continents. Without speculating about its future, we may admire the simplicity of its grammar and the terseness and conciseness of style by which so many of its scientific worthies have distinguished themselves. We are very pleased to see so many of its representatives in our midst and I feel sure that they will largely contribute to the success, both of this and of many future International Zoölogical Congresses.

And now I propose to give you all the most hearty *welcome to Holland!*

Auf Ihr wohl, meine Herren.

Je vous souhaite la bienvenue à vous tous et je bois au succès du prochain troisième Congrès International de Zoologie.

MONDAY, SEPTEMBER 16TH.

The Congress was formally opened by an address from the Minister of the Interior, M. van Houten, honorary President of the Congress, which was responded to by the President, Dr. Jentink, Sir William Flower on behalf of Great Britain, Professor A. Milne Edwards for France, Baron E. de Sélys de Longchamps for Belgium, and Dr. C. W. Stiles for the United States. Professor Weismann was then called upon and delivered a long and formal address, the publication of which will be awaited with great interest. He defended the principle of natural selection and developed certain new ideas complementary to this principle. Darwin and Wallace have proved the existence of selection between individuals, and Roux has shown that there is a struggle between the constituent parts of each organism. This struggle is of the highest importance for the life of the organism and, *à fortiori*, for the existence of the species. It is necessary, in the third place, to call attention to what the speaker has named *germinal selection*. The smallest vital units, the biophors and determinants, of which, according to his ideas, all living organisms are formed, are in more or less favorable reciprocal conditions. It is just this which gives us the key to the fact that useful variations are always presented when selection requires them. The direction in which variations develop is determined by their utility. Here is an automatic mechanism which determines that useful variations shall be protected from their incipient stages, and under the sheltering mantle of individual selection these variations attain complete development. This dominant idea was supported by numerous examples taken from organisms which are advancing, as well as from those which are retrograding. The principle of Panmixia is thus logically completed and it becomes possible to explain why harmonious variations in different parts of the organisms are produced simultaneously.

Professor R. Blanchard reported on behalf of the committee that the prize instituted by the Emperor of Russia had been awarded to Dr. R. T. Scharff, of Dublin.

The following gentlemen were appointed permanent secretaries of Sections: Section I., Professor J. van Rees, Amsterdam; Section II., Dr. C. L. Reuvens, Leyden; Section III., Professor J. F. van Bemmelen, the Hague; Section IV., Professor G. C. J. Vosmaer, Utrecht; Section V., M. H. P. Nierstrasz, Utrecht; Section VI., Professor M. C. Dekhuyzen, Leyden. The presidents of Sections were changed at each meeting. At 2.30 P. M. the Sections held their first meetings and were classified as follows: I. General Zoölogy. Geographical Distribution (including extinct faunas). Theory of Evolution. II. Classification and Distribution of recent and fossil Vertebrates. III. Comparative Anatomy of recent and extinct Vertebrates. Embryology. IV. Classification and Distribution of recent and extinct Invertebrates. V. Entomology. VI. Comparative Anatomy and Embryology of Invertebrates. This arrangement is re-

markable for the full recognition given to paleontology as a branch of zoölogy.

Prof. Sedgwick (Cambridge) read a paper on Cellular Theories, in which he pointed out the morphological inconsistencies and absurdities to which the prevalent theories lead.

Prof. Hensen (Kiel) made a report upon his Plankton studies, of which he considered the most interesting result to be the fact that the method of measuring percentages of various animals collected at different depths by fine, self-closing nets proves to be exact and may be employed as a basis for further investigations.

Prince Roland Bonaparte spoke of the researches in marine zoölogy made on the steamer 'Roland,' which he had placed at the disposal of M. de Lacaze Duthier.

Prof. Lütken (Copenhagen) spoke of the expedition for exploration of the great depths of the subarctic seas.

Prof. Scott (Princeton) made some remarks upon the relation of individual variations to the origin of species.

Prof. de Zograf (Moscow) gave a paper upon the origin of the lacustrine fauna of European Russia. The Russian lakes may be divided into four groups, the first derived from a bay of the White Sea and from a glacier; the second and third are the remains of glaciers. These three regions have the same limits as the three glaciers of the latter glacial periods of Geikie. The fourth group is derived from the Black and Caspian and other ancient seas which once covered southern Russia.

M. Vaillant (Paris) spoke of his researches on the structure of the osseous spine in the carp

Prof. Emery (Bologna) made a communication upon the polymorphism of ants and upon alimentary castration, defending the principle that the sterility of neuters and their different forms are chiefly due to the way in which the larvæ are fed.

The paper of M. Wasmann (Exaeten) dealt principally with the determination and classification of the ants and termites, giving the criteria of division with especial reference to those morphological characters which are of an adaptive nature.

At 4:30 P. M. the members of the Congress were received, by invitation of the Municipal Council of Leyden, in the Town Hall, where the Burgomaster welcomed them in a graceful speech, to which the President, Dr. Jentink, responded. The day was very agreeably ended by a concert at Katwijk given to the Congress.

TUESDAY, SEPTEMBER 17TH.

Prof. O. C. Marsh (New Haven) gave a paper upon the affinities and classification of the Dinosaurian Reptiles, illustrated by diagrams of *Aëtosaurus*, *Hallopus*, *Triceratops*, *Stegosaurus* and others, and of footprints, one of which shows a difference in the number of digits of the fore and hind feet. A new classification of the Dinosauria was proposed.

M. Büttikofer (Leyden) gave an account of the Dutch expedition to the interior of Borneo.

Prof. Lütken spoke of the investigations made in Denmark upon the fossil mammals of the Brazilian caverns.

Dr. C. W. Stiles (Washington) read a paper on the 'Revision of the Leporine Cestodes,' based upon the original types of European species and upon extensive American material. None of the European species have been found in North America.

M. S Goto (Tokio) gave a short report on some ectoparasitic Trematodes from the Atlantic coasts of the United States and communicated also a case of synonymy of an European species. The species treated of are as follows: (1) Tristomum læve, Verrill. Examination of an original specimen shows that this is identical with the species described under the name

of Tristomum ovale by the speaker, so that Tristomum ovale, Goto, is a synonym of Trist. læve, Verrill. (2) Phyllonella hippoglossi (P. J. v. Beneden). This is the species called Epibdella hippoglossi by v. Beneden. The distinction between the two genera is that Epibdella has a pair of well-developed anterior suckers, while Phyllonella has none. The vagina is present and opens into the yolk reservoir, as in other species of Tristomidæ. The 'vésicules séminales' of v. Beneden is the prostate gland and the internal cavity of the penis, while the vesicula seminalis of Cunningham is the vagina. (3) Polystomum Hassalli, n. sp. This species was found by Dr. Hassall, of Washington, in the bladder of Kinosternon pennsylvanicum. Body 1.5 mm. long, egg-shaped, genital hooks 16(3) and of the same size. Ovary sometimes on the right, sometimes on the left side. Intestine bifurcated, not branched. The Polyst. oblongum of Leidy is *not* Polyst. oblongum, Wright. (4) Hexacotyle thunninæ (Par. et Per.). This is the Octocotyle thunninæ of Parona and Perugia. The form of the body, the structure of the suckers as well as that of the vagina, shows that the species ought to be brought under the genus Hexacotyle.

In conclusion the speaker referred to the so-called 'grosse Zellen.' Under this name structures of various natures have been included, viz., (1) ganglion cells, (2) connective tissue cells, (3) gland cells.

Prof. S. J. Hickson (Manchester) in speaking of the classification of the Alcyonaria referred to the difficulty there is in finding sufficiently distinct characters to separate the Alcyonaria Gorgonacea. He considers that the Corrallidæ and Briarcidæ should be included among the Alcyonacea and not among the Gorgonacea.

The author then referred to some difficulties in the determination of species from museum specimens of Alcyonarians.

Prof. R. Blanchard (Paris) made a communication upon the leeches of the Dutch East Indies and of the Indo-Malayan region.

M. Dollfus (Paris) read a paper on the distribution of the isopod family, *Oniscidæ*, in Europe. This group is particularly favorable for such studies, for most of its species exactly follow climatic zones. Most of them belong to the Mediterranean region, *stricto sensu*; some present curious phenomena of penetration toward the north or south, and a single one is ubiquitous. Three species of *Armadillo*, one of *Eluma* and twenty-five of *Armadillidium* were considered.

Baron E. de Sélys de Longchamps (Liége) presented a paper entitled 'Progress in knowledge of the Odonata.'

M. Piepers (the Hague) spoke of supposed cases of mimicry among the insects, and expressed doubts concerning several so-called facts to which a place has been accorded in science before they have been sufficiently studied.

Prof. Perrier (Paris) gave an account of the marine laboratory on the island of Tahiton, of which he is the founder and director. It supplies facilities for researches in pure science, also for those bearing on fisheries and pisciculture. It is furnished with all necessary appliances and covers a space of 4 hectares.

M. Bolsius (Oudenbosch) read a paper upon the nephridea of the leeches, which, he contended, are separate from the ciliated organs. Prof. Kowalevsky (St. Petersburg) then gave a paper on contributions to the anatomy of the Clepsines.

Prof. Julin (Liége) communicated the work of his pupil, R. Legros, on the structure and development of the sexual organs in *Amphioxus* and the Ascidians. In both groups there is close homology in the formation of the sexual products. The cavity of the ovary and testis is homologous

with that in *Amphioxus* (cœlom). The simple epithelium covering the germinal epithelium, together with that covering the sexual ducts, is, as a whole, homologous with the somatopleuric and splanchnopleuric epithelium covering the sexual glands of *Amphioxus*.

In the afternoon no Sectional meetings were held, the time being given to a lecture by Prof. Scott (Princeton) on the Tertiary Lakes of North America and their Mammals, which was illustrated by lantern slides. The lecturer pointed out that paleontology must be founded upon exact stratigraphy, and then gave an account of the American Tertiaries, indicating their European equivalents. Especially dwelt upon were the remarkable continuity of the American Tertiary horizons, their vast geographical extent, and the abundance and excellent preservation of their mammals. Many phylogenetic series may be worked out with great completeness, and from these may be deduced important laws as to the mode of development among mammals and their migration from one region to another.

In the evening a very large and brilliant audience, including the Queen and Queen Regent of Holland, assembled in the Concert Hall for the lecture of Dr. R. Bowdler Sharpe, of the British Museum, upon 'Some Curiosities of Bird Life.' The lecture was illustrated by a remarkable series of lantern slides painted by the Dutch artist Keulemans.

After Dr. Sharpe's lecture a reception to the Congress was given by the members of the students' club 'Minerva,' in their spacious and luxurious club house.

WEDNESDAY, SEPTEMBER 18TH.

The second plenary session of the Congress was opened at 10 A. M. Professor A. Milne Edwards then delivered a lecture upon the resemblances of the fauna of the Mascerene islands and that of certain islands in the south Pacific. The lecturer pointed out the importance of the study of sedentary animals for the solving of distributional problems. The former existence of flightless birds in Madagascar and the neighboring islands has long been known. In 1889 M. Sauzier exhumed a large quantity of bones, which enabled Newton, Sclater and others to confirm the accounts of the traveller Leguat. The researches of Forbes, Newton and Hutton were then considered. These show that the Mascarene islands were formerly part of a great land area, which has been submerged beneath the ocean.

M. E. L. Bouvier (Paris) presented a report upon Dr. Herbert H. Field's plan of bibliographical reform and for the establishment of a central bibliographical bureau for zoölogy. The recommendations of the report are: (1) An International Bureau shall, as soon as possible, give effect to Dr. Field's plan for the reform of zoölogical bibliography. (2) National committees, established in each country, under the auspices of the zoölogical societies, will coöperate to simplify the work of the Bureau and to facilitate the reform. (3) In order to supply the Bureau with the necessary resources, the national committees will obtain subscriptions from individuals and learned societies. (4) An International Commission shall be appointed by the Congress to audit the accounts, assure the permanence and supervise the operations of the Bureau. This commission shall be composed of seven members, each of a different nationality; it shall report to the International Zoölogical Congress, and shall be renewable, in alphabetical order, at each meeting of the Congress.

These recommendations were unanimously adopted and the following commission was then appointed: For England, Prof. S. J. Hickson; for France, Prof. R. Blanchard; for Germany, Prof. J. W.

Spengel; for Holland, Dr. P. P. C. Hoek; for Russia, Prof. W. Schimkewitsch; for Switzerland, Prof. A. Lang; for the United States, Prof. W. B. Scott.

Prof. F. E. Schulze proposed the appointment of a commission of five members to codify the rules of nomenclature of living beings now used or recommended in various countries; the code to be published with the same text in three languages.

The proposition was unanimously adopted and the commission appointed as follows: Prof. R. Blanchard (Paris), Prof. Victor Carus (Leipsic), Dr. F. A. Jentink (Leyden), Dr. P. L. Sclater (London), Dr. C. W. Stiles (Washington).

The following resolutions introduced by Dr. Stiles were unanimously carried:

Whereas, The Third International Zoölogical Congress considers Article 16, 3–1(1) of the Universal Postal Convention of Vienna, forbidding the transmission through the mails of "*animals and insects, living or dead, excepting the cases provided for* [*i. e.*, live bees] *in the Regulations of detail*," as a hindrance to the advancement of science, and

Whereas, Switzerland is at present the seat of the *International Bureau of the Universal Postal Union*, be it therefore by this Third International Crongress held at Leyden, September 16–21, 1895,

Resolved, That this Third International Congress respectfully petition the Swiss Federal Government through its delegate, Prof. Studer, to introduce, at the next International Postal Congress, the following amendment to Article XIX. (Samples), 4, of the '*Regulations of Detail and Order*,' *i. e.*,

5th. Natural History Specimens—such as dried or preserved animals and plants, geological specimens, etc.—not sent for commercial purposes, provided the packages conform to the general conditions prescribed for 'Samples of Merchandise;' and be it further

Resolved, That this Third International Congress call upon all of its delegates and members to bring this amendment to the attention of their respective governments, and to urge the several governments to instruct their delegates to the next International Postal Congress (Washington, D. C., 1897) to support the same; and be it further

Resolved, That the Secretary of this Third International Congress send a copy of these resolutions to every government represented in the Universal Postal Union, but not represented at the Third International Zoölogical Congress.

Wednesday afternoon was occupied by an excursion to the Hook of Holland.

THURSDAY, SEPTEMBER 19TH.

Sectional meetings at 10 A. M. Prof. Apáthy (Klausenburg) presented a paper upon a controlling element and its position with reference to the cells in invertebrates and vertebrates. The speaker distinguished between ganglion cells and nerve cells; the latter (as the muscle cells do for the contractile substance) produce the controlling substance which grows out, reaches and penetrates ganglion cells, sensory cells and muscle cells. This is done by means of the intercellular bridges, derived from the embryo, which always connect together the cells of the body. The old conception of Max Schultze has thus again been brought forward in opposition to the views of Bütschli, Leydig and others. By the gold chloride method, confirmed by methyl blue and other stains, Prof. Apáthy has been able to distinguish both kinds of cells and the finer details of the controlling primitive fibrils, especially within the ganglion cells, and also to establish the connection between the controlling motor and sensory primitive fibrils. An extremely interesting demonstration of these facts was given at the close of the session.

M. C. Janet (Beauvais) read a paper

showing that the problem of species and their variations may be compared to the examination of the positions of equilibrium of a point placed on a resisting surface and submitted to the action of a force which is a function of the coördinates of the point. The discussion of this problem of mechanics, translated into zöological language, leads to the following conclusions: That in a given fauna in a given environment there is but a limited number of possible species, and that the passage of the initial forms to the definitive forms will be made very rapidly. This explains the small probability of finding remains of the transitional forms. The same applies to the transition of one fauna to another under the action of a changed environment.

Prof. Eimer (Tübingen) spoke on definitely directed development (orthogenesis) and the impotence of Darwin's selection in the formation of species; also upon the development of species and affinities of the swallow-tailed butterflies. The speaker's works, which in part have been published for years, especially those on the markings of animals, show that definitely directed development is an unquestionable fact and his continued investigations everywhere confirm this. Variation always takes place in a few quite distinct directions, progressively, or sometimes (Foraminifera) retrogressively, *never* 'oscillatingly.' Utility plays no part, either in the minimal beginnings or in the further development. Transformation is to be referred to the influence of the environment upon a given constitution. Selection can create nothing new, but what is developed *may* become useful and be selected. The separation into species of the chain of organisms thus formed occurs chiefly through arrest at definite stages of development (Genepistasis) as well as by saltatory development (Halmatogenesis) and by hindrance of fertilization (Kyesomechania). Even the origin of apparently mimicking forms is to be explained by definite directions of development (independent similarity of development, Homœogenesis). Only thus, not by selection, is the origin of mimicry made intelligible. The speaker employed, as evidence for his views, figures of the *Papilionidæ*, from which, as he said, the laws of development and of the formation of species may be read as from the letters of a book. The fact of the definitely directed development of non-useful characters completely refutes the lately propounded 'germinal selection.' Speculation may have its place in natural science, but it must not ignore *facts* previously established.

Dr. R. Bowdler Sharpe presented a paper on the geographical distribution of the birds of prey, and M. F. Mocquard (Paris) one upon some new reptiles and amphibians from the upper Congo.

Dr. T. Schmitt made a communication on the principles followed in preparing the new edition of the Scandinavian Fishes.

In the paper of M. Forrest, presented by the Baron d'Hamonville, upon the ostrich, egrets and birds of paradise, the principal points were: (1) Reintroduction of the ostrich into North Africa. (2) To have measures for the protection of the egrets universally adopted. (3) To obtain protection for the birds of paradise.

Prof. W. Leche (Stockholm) gave an outline of his investigations upon the development of the dental system in mammals, emphasizing the general considerations which are to be regarded in this question. He dwelt upon the fact that the serial appearance of the teeth had been only gradually acquired and also that there are no impassable barriers between the different dentitions. He pointed out the occurrence of at least four dentitions in the mammals and made some statements concerning the genesis of these.

Prof. Semon (Jena) spoke on the fœ-

tal membranes and appendages of vertebrates. He referred the formation of the amnion to the need of protection for the germ when the eggs are laid on land. Mechanically regarded, the process may be considered as a sinking, first of the front end, and then of the hinder end, of the embryo into the yolk sac. The development ment of the allantois as a respiratory organ keeps pace with the sinking of the embryo. In the structure and development of their fœtal membranes and appendages the monotremes stand between the Sauropsida and the higher mammals.

Prof. Hubrecht (Utrecht) gave a demonstration of lemurine placentas. He finds the placentation of *Tarsius* to be entirely different from that of *Nycticebus* and other lemurs. While *Nycticebus* has a diffuse placenta, in *Tarsius* the chorion is quite thin and transparent, except at one spot, which forms a discoid placenta, so to speak. This develops at first as a massive cone, which grows into an especially modified part of the uterine wall. The allantois grows into this cone and surrounds the maternal blood vessels.

Prof. Zograf (Moscow) made a communication upon the teeth of the chondrostean ganoids. The sturgeons possess teeth in the young stages which are preserved longer in the eastern species than in the western. A series may be made from the sterlet (*A. ruthenus*), which loses its teeth toward the end of the first year, to *Psephurus gladius*, which retains them throughout life. The American *Polyodon folium* also retains its teeth permanently, but nothing is known in this respect of the other sturgeons of that continent. It is to be hoped that American investigators will soon clear up this point.

Mme. Céline Renooz (Paris), in a paper on the embryonic development of vertebrates, explained her views as to the derivation of aërial animals from plants and the vegetable traces which occur in the first stages of embryonic development.

Prof. van Bemmelen (the Hague) presented a paper on the phylogeny of the Testudinate reptiles. The perforated cranial roof of the fresh-water turtles, as well as that of the lizards and snakes, must be derived from the uninterrupted roof of the marine forms. In the series of turtles the quadrate has developed into a tympanic ring, probably homologous with that of the mammals. The plastron contains elements of different phylogenetic antiquity; the anterior three are the homologues of the episternum and clavicles.

Prof. Kowalevsky spoke of the lymphatic glands of *Scorpio europœus* and certain allied forms. In some of these may be distinguished one class of glands which deals with solid substances and the lymphoid glands which prefer dissolved matters.

Prof. Schimkewitsch made a communication upon the first stages of development in the parasitic copepods. He has observed the segmentation, the formation of the germ layers, the very precocious development of the germinal cells, and the formation of the nervous system in the same way as in *Gammarus* as given by Bergh.

Prof. Gilson (Louvain) described the special muscular organs which he has discovered in the dissepiments of *Owenia*. It seems certain that these organs serve to regulate the pressure of the perivisceral fluid in the different segments and occasionally to isolate certain segments. Epithelial tubes situated in the fifth and sixth dissepiments and opening externally lead to the septal canal, and seem destined to introduce water into the perivisceral cavity for the needs of the hydraulic mechanism which constitutes the body of this tubicolar annelid.

M. Dautzenberg (Paris) gave an account of new molluscs dredged from near the Azores and the coast of Senegal—another

instance of the wide distribution of deep sea forms.

Prof. Perrier (Paris) spoke on the classification of worms. The Nematodes, with *Echinoderes*, *Gordius* and *Acanthœphalus*, are separated from the worms and, under the name Nematelminthes, united with the Arthropods. The Plathelminthes and Annelids constitute the worms proper. The Rotifers, Bryozoans and Brachiopods form a group (Lophostomata) transitional between the Plathelminthes and Annelids.

Prof. Julin (Liége) read an elaborate paper on 'the epicardium, pericardium, heart and stolon in the larvæ of *Distaplia magnilarva*,' which is not reported in the Bulletin of the Congress.

Prof. Salensky (Odessa) gave an account of the development of the heart in the frog, from which it follows that the vertebrate heart is totally different from that of the Tunicates and that the endocardium is of mesodermal origin.

Prof. Eimer read a paper upon the formation of the tailed species of *Papilio*, in which he further developed his ideas on Orthogenesis referred to in the former paper.

The day was charmingly concluded by a 'dîner intime' in the Kurhaus at Scheveningen.

Friday, September 20th, was devoted to excursions to Helder, Marken and Graveland.

SATURDAY, SEPTEMBER 21ST.

The paper which excited perhaps the greatest interest of all those presented to this Congress was that by Dr. E. Dubois on '*Pithecanthropus erectus*, a transitional, man-like form.' Dr. Dubois described the locality in Java where the remains were found, and mentioned as occurring near them a tooth of *Hyœna*, bones of *Cervus*, etc. No complete skeleton was found. The speaker then described the cranium and femur, of which he had maintained that they belonged to a man-like creature. He had compared the thigh bone with 150 different femora of Malays, Negroes, Europeans and other races, but could establish no similarity. Virchow's view of the greater resemblance of this femur to that of the apes (especially *Hylobates*) is correct. It is remarkable that the zöologists maintain the skull to be human, while the human anatomists refer it to the apes. The speaker discussed the cranial capacity of man and the anthropoid apes, with especial reference to the Neanderthal skull. In his published work Dr. Dubois had not referred to a second tooth found later among the excavated material. The speaker concluded that *Pithecanthropus erectus* should be placed between man and the anthropoid apes, that it represents a peculiar type and renders necessary the formation of a new genus.

Prof. R. Virchow (Berlin) opened the discussion with the statement that he agreed better with Dr. Dubois than would be supposed from newspaper accounts. He displayed some human femora, with exostoses like the Javan specimen. Virchow inclined to the view that the femur was human, but could not deny that the whole appearance of the bone was not man-like; it is most like that of *Hylobates*, but gigantic compared with the recent gibbons. He expressed himself positively against the opinion that the skull is human and explained the importance of the orbital region in such questions. Dubois' discovery is a very important one.

In reply Dr. Dubois pointed out the likeness of this skull to that of Neanderthal.

Prof. Marsh called attention to the great age of the bones. He had often observed similar exostoses on fossil femora. It is extremely desirable to establish the antiquity of the specimens.

Prof. Rosenberg (Utrecht) pointed out certain characteristics of femora; the long axis and its curvature, the linea obliqua,

crista trochanterica, linea aspera, angulus medialis, &c. Of the human femora examined, one showed all four peculiarities of the Javan specimen, so that he doubted whether the latter differed from a human femur. He also doubted the reference of the skull and explained why he did not believe that *Pithecanthropus* had an erect gait. He would like to have these bones compared with those of the New World monkeys.

Prof. Martin (Leyden) stated that the age of these bones could only be late Pliocene or early Pleistocene.

Sir William Flower laid much stress upon the correspondence between the skull of *Pithecanthropus* and that of *Hylobates*.

Dr. Bashford Dean (New York) spoke 'On the Embryology of the North American Ganoids, *Accipenser*, *Lepidosteus* and *Amia*,' and exhibited a number of specimens illustrating their embryonic and larval development. A comparative study of these forms emphasizes the results of the palæontologist as to the phylogeny of the Teleosts, *i. e.*, their descent from a series of transitional Mesozoic Ganoids, as Leptolepids, Caturids; it interprets also the difficulties of the embryology of the Teleost, *e. g.*, the origin of the periblast, the mode of grastulation, of blastulation, the significance of Kupffer's vesicle, of the solid neural axis, and of the specialized origin of the mesoderm. In a series of diagrams of saggital sections of early and late grastulæ there was shown on the screen a more detailed comparison; thus in *Lepidosteus* shark like features were apparent, the conditions of the development of the germ layers of ventral and dorsal lip were closely similar, and by the time of the blastopores closure the appearance of the embryo was hardly to be noted. In *Amia*, on the other hand, the precocious character of the development of the embryo was extremely notable, forming clearly marked transitional conditions to the Teleosts.

At 2 P. M. was held the third and last session of the full Congress, when Mr. John Murray (Edinburgh) delivered a lecture upon 'Deep Sea Explorations.' He showed the respects in which our knowledge of the great ocean depths and of their animal life has so greatly increased in the last 40 years, and that the biological sciences have reaped the chief benefit of such increase. The greatest measured depth in the sea is 8500 metres, the mean depth 4500 metres. About 5 per cent of the deep part is 5500 m. or more. Mr. Murray then gave an account of the investigation of the bottom deposits undertaken by himself and M. Rénaud, of Brussels, which had led to such important results. The question of temperature was then taken up. This varies at the surface from 28° at the equator to 0° at the poles; at the bottom the water has a temperature almost everywhere equal and constant, averaging 3°. It is especially remarkable that in the tropics the number of deep sea species is much greater than in temperate regions, but in the latter the number of individuals of each species is far larger. The speaker then considered some of the characters of deep-sea animals. We have not succeeded in finding animals which can be considered representatives of extinct faunas. The forms are distinct; they are often of considerable size, they carry phosphorescent organs and usually have no striking colors; but on the whole they resemble animals from less profound depths. A very curious point is the resemblance between the deep sea forms of high latitudes, north and south. This was explained by assuming that the bottom had formerly the same fauna everywhere. The temperature was then uniform and a rich flora flourished at the poles, as at the equator. At that time the sun did not give out much more heat than at present, but its radiating surface was far larger, and therefore the distribution of solar heat upon the

earth was quite different from that which obtains at present.

Baron d'Hamonville next made an eloquent plea for protection to the birds of paradise and appealed to the ladies for support in this movement.

Dr. Herbert H. Field (Brooklyn) transmitted to the Congress a proposition of Prof. E. L. Mark, Cambridge, U. S. A., to "consider the desirability and feasibility of constructing a code of abbreviations in animal morphology based upon Latin names and to be recommended for general use by zoölogists and anatomists throughout the world."

The Congress voted unanimously that Sir William Flower should be the president of the fourth Congress, and that this should be held in England, the president-elect to agree with his English colleagues upon the place of meeting.

After speeches from MM. Milne-Edwards, Studer, Sélys-Longchamps and Flower, expressing the high appreciation felt by all the members for the admirably successful labors of the Dutch committees and the remarkable character of the work laid before the Congress, the president declared the sessions of the Third International Zoölogical Congress to be closed.

RELATIONS OF THE WEATHER BUREAU TO THE SCIENCE AND INDUSTRY OF THE COUNTRY.

Mr. President and members of the American Association for the Advancement of Science:

It is a matter of much pleasure to me that I am allowed the privilege of speaking at a joint session of this Association—representing as it does within the confines of its admirable organization the scientific thought of our country. This is the Mecca towards which annually journey all those who wish, each to contribute his mite to the sum of human knowledge; each inspired with an ambition to add even one flickering ray to the great luminous orb which to-day is shedding the benign light of wisdom even unto the uttermost recesses of the earth; subduing the barbarous instincts of man and warming and invigorating into life the better impulses of his nature. Thus is civilization advanced, and thus is humanity elevated to higher and higher planes of existence.

I hope to be a worker in the ranks of this great army, and as the science of meteorology can hardly be said to have passed beyond the embryonic state, I feel that the realms of investigation are boundless, and that the opportunities are correspondingly great.

As the Chief of the greatest meteorological system in the world, and with the power to control, under the direction of the Honorable Secretary of Agriculture, not only its executive functions, but the lines of future scientific investigation, I fully realize the great responsibility that rests upon me, and that, at the bar of public and scientific opinion, I shall, in the years to come, justly be held to a strict accountability for my stewardship.

Before considering the lines of investigation which can consistently be prosecuted by the Weather Bureau, it will be well to note the law which prescribes the duties of the chief.

By an Act Congress approved October 1, 1890, Sec. 3, Statutes at large, Fifty-first Congress, p. 653, it is provided:

"That the Chief of the Weather Bureau, under the direction of the Secretary of Agriculture, on and after July 1, 1891, shall have charge of the forecasting of weather, the issue of storm warnings, the display of weather and flood signals for the benefit of agriculture, commerce and navigation, the gauging and reporting of rivers, the maintenance and operation of sea-coast telegraph lines and the collection and transmission of marine intelligence for the benefit of commerce and navigation, the reporting of temperature and rainfall conditions

for the cotton interests, the display of frost and cold wave signals, the distribution of meteorological information in the interests of agriculture and commerce and the taking of such meteorological observations as may be necessary to establish and record the climatic conditions of the United States, or as are essential for the proper execution of the foregoing duties."

It will be seen that the main object for the existence and continuation of this Bureau is to give warning of the approach of storms, and therefore that the proper line of investigation should be for the purpose of determining the true philosophy of storms. The goal to be striven for is the improvement of weather forecasts, and surely one of the prerequisites to determine coming events is a thorough knowledge of existing conditions.

To those who have read every important treatise on meteorology, and who have studied every text-book on the subject, it is painfully patent that we are extremely ignorant of the mechanism of storms; of the operations of those vast and subtle forces in free air which give inception to the storm and which supply the energy necessary to accelerate cyclonic action when formed, or to disperse the same when once fully in operation. We know that great atmospheric swirls in the shape of high and low pressure areas alternately drift across the country at intervals of two or three days; that the atmosphere flows spirally into the cyclonic or low-pressure system and outward from the anti-cyclonic or high-pressure system, that the in-drawn east and south winds on the front of the storm are warm, and that the inwardly-flowing north and west winds are cold.

The theories of Redfield, Espy, Loomis, Ferrel and others, teach that our great storms are composed of immense masses of air gyrating about a vertical or nearly vertical axis, drifting eastward and at the same time drawing in warm easterly currents at the front and cold westerly currents at the rear; that the commingling of these two as they rise to greater and greater elevations, near the regions of the cyclonic center, throws down volumes of rain or snow; that as precipitation occurs with the ascending currents, the heat of condensation energizes the cyclonic circulation; that the air at the center of the storm is relatively warm, is rarefied by centrifugal force and by reason of less density, rises to a great elevation, and in the upper regions of the atmosphere flows away laterally to assist in building up high-pressure areas on either side.

The high and low-pressure areas are supposed to be carried eastward by the general easterly drift of the atmosphere in the middle latitudes, somewhat as eddies are carried along by water in a running stream.

But, unfortunately for the complete accuracy of these theories, the forecaster often finds heavy down-pours of rain without any cyclonic circulation, and no convectional system in operation; again over immense areas of country, especially in the Rocky Mountain region, for many months in the year condensation occurs not at all in the warmer easterly currents flowing into the storm center, but almost exclusively in the westerly portion of the storm area, where the cold north and west winds are flowing in.

Again, many investigators to-day have good reason to doubt that the center of the storm is warm to any great elevation or that cyclonic circulation obtains to the top of the air.

In outlining, in a rough and general way, the line of investigation which in my judgment promises to give the most prolific results, not only to the cause of meteorological science, but to the making of more accurate forecasts for the benefit of agriculture and commerce, I will say that we have been for

years taking our measurements at the bottom of this great ocean of air, while the forces which cause the formation of storms, and which influence their intensity and direction of motion, operate at great elevations, or are extraneous to our earth. It therefore seems imperative that systematic exploration should be made of the upper air. Balloon ascensions should be made in the several quadrants of the cyclonic storm and also at the center thereof, especially when rain is falling and the barometric gradient is steep. It is especially important to know the level at which condensation ceases, the depth of the cloud stratum, the temperature gradient, the air pressure and humidity, to a height of four or five miles. Skilled aëronauts with complete and accurate instruments should be placed in the region of severest action at the season of the year when storms are most frequent. They should be held in readiness until the approach of storms typical of cyclonic action, and then from the central office, where the movement of the storm is being carefully watched on the daily synoptic chart, they should be given telegraphic orders to ascend, and their ascensions should be so timed as to secure accurate readings at great elevations throughout the several quarters of the storm. It is believed that information thus secured will establish something like an approach to the true philosophy of storms in contradistinction to the very imperfect theories which too often are hastily approved as demonstrated principles. Instead of erecting a cumbersome superstructure upon the sand, let us endeavor to lay a corner stone upon which to erect something exact enough to be called a science.

In winter the great high-pressure areas which constitute our cold waves should receive the same thorough exploration. Readings at Pike's Peak or Mt. Rainier might be useful in this investigation, but they are too far removed from the general track of storms and cold waves to furnish the full information desired.

Upper-air explorations may be accomplished by a train of kites carrying automatic instruments, by captive kite-balloons which may be forced nearer and nearer the zenith with increasing wind velocity, or by the ascension of trained observers in free balloons. We must strive for the perfection of appliances and instruments which will, at no distant day, enable us to present to the forecaster the charted synchronous meteorological conditions prevailing at high levels and covering a great area. Mr. McAdie, at Washington, has secured recently some good records with kites at elevations of from 1000 to 2000 feet.

Systematic exploration of the upper air, with a continuation of the studies begun by Professor Bigelow of terrestrial magnetic forces as induced by the solar magnetic field, will be the line of investigation prosecuted during the next two years, and from which it is hoped that results satisfactory to the practical as well as the theoretical man may be obtained.

The Honorable Secretary of Agriculture is in thorough sympathy with all lines of research which can be legally carried on under the Act of Congress constituting the Weather Bureau, and which promise to give results useful to the people.

Harmonious coöperation between the practical worker and the scientific investigator is essential to success. Too often they have found themselves picking out diverging paths. In the future they will work on parallel and converging lines and not far removed from each other, and the result, I am confident, will be beneficial to all. In a great system like ours each worker must be justly recognized for the merit that is in him, whether he be a skilled scientist or an able executive officer, and he should be given his proper place as an in-

tegral part of the great whole which constitutes the efficient Bureau.

A brief retrospect of the forecast work may not be without compensating results in our efforts at future improvements.

Forecasts were begun in the United States about 25 years ago, and have, during the past decade, become of such benefit to the many and diversified interests of the country that with one accord the people now acknowledge their value and applaud all efforts to improve and extend their usefulness. Fifty million dollars is a low estimate of the value of property placed in jeopardy by one West Indian hurricane sweeping up our Atlantic coast.

Predictions were first called 'Probabilities' and were made for districts, each comprising several States, and included a prediction as to the probable change in barometer. Later the prediction as to barometer was omitted. Forecasting by districts was soon shown not to be specific enough as to boundary, and the designations applied were not well understood by the people; hence forecasting by States was adopted.

Forecasts were made only at the Central Office at Washington, and the local observers were allowed to disseminate no other, nor to give public expression to any opinion of their own which might be construed into a forecast. Considering the very limited training of the observers and the lack of all charted meteorological conditions for their study and enlightenment, the wisdom of that regulation could hardly be questioned.

With the transfer of the Weather Bureau to the Department of Agriculture came the inauguration of far more liberal and progressive ideas. The office of Local Forecast Official was created for such observers as had shown special fitness for forecast work, and they were assigned to duty at the more important agricultural, commercial or maritime centers, with instructions to carefully study the local climatology of their sections, so that products that are indigenous to limited areas, or interests which are of special importance to particular sections, might have such application of the weather forecasts as the intimate personal attentions of a competent local official could give.

The changes enumerated have been carefully tested and found to be beneficent in purpose and worthy of continued and permanent application. Thus has the forecasting system of to-day slowly developed during the past 25 years. Is it not the essential feature of the Weather Bureau? Is it not the nucleus around which all departments of thought and study must rotate and become auxiliary, if the original intent of Congress made manifest by the establishment of a National storm-warning system is to be carried foward to as successful an operation as the present knowledge of the physics of the air will permit? It is hoped that discoveries may be made relative to the controlling and modifying forces of storms which shall raise the standard of forecasting accuracy attained by our most expert officials, who have had all the benefits to be derived from many years of patient and intelligent observation of storms, from the time of their inception in, or entrance within our daily observed and charted territory, until they have been dissipated or have passed eastward beyond our range of vision.

It may be well to consider what class of forecasts can be most successfully made by our more or less empirical methods, the object being to extend the work along such lines of activity as promise the most beneficial results.

As to this proposition it is doubtless conceded by all that when pronounced high and low-pressure areas dominate the weather conditions and the changes in wind, temperature and weather are charac-

terized by such force and degree as to render them destructive to lives and property, a forecaster of average ability and well-balanced judgment is able to make nearly or quite as accurate a forecast as when the air pressure is quite uniformly distributed and all changes of weather are so slight as to be of no importance.

If, then, a destructive frost or cold wave can be predicted as easily as a change of a few degrees in temperature, and if the coming of high winds and gales are as easily foretold as that of a gentle zephyr, it is evident which class of forecasts should receive the greater attention. The public care comparatively little for predictions of moderate changes, and but little credit attaches to the Bureau when such forecasts are verified, but when great heat, cold waves or violent winds are on the programme, a vital interest is felt in the subject, and the accurate forecasting of such conditions is the gauge by which the public measures the usefulness of the Bureau.

Horticulturists and the growers of tobacco and cranberries realize the vast benefit to be derived from accurate frost predictions, and I will give a brief statement of what I believe to be original ideas introduced into the making of frost forecasts while in charge of the State Weather Service of Wisconsin, a State including within its domain the largest area of cranberry marshes in the world, and also including an extensive area devoted to the cultivation of tobacco. Heretofore I believe that only the air conditions have been taken into consideration in the making of frost forecasts—such as pressure, temperature, relative humidity, cloudiness and wind velocity. As a result of my investigations systematically prosecuted for three years I found that the conditions of the soil were equally as important as those of the air.

When the high-pressure area is moving in from the west, clear and colder weather anticipated, with the probability that the early morning temperature will permit the formation of frost, the most important elements to be considered, in determining whether or not frost will occur injurious to growing crops, are as follows:

First: Has rain recently fallen, and what is the condition of the soil relative to the amount of moisture contained?

Second: What are the natural properties of the soil relative to the slow or rapid loss of heat by radiation?

Third: To what degree of heat has vegetation been subjected during the period immediately preceding?

The early fall frost injurious to tender crops occurs with the observed town or telegraphic minimum temperature ranging from 40 to 50 degrees, because, when the early morning temperature in the town falls much lower than 40 degrees, it is usually so late in the season that all crops are gathered, or if not gathered they have been destroyed ere this condition arrives. At the time then that frost warnings are of most benefit we have to deal with the air at temperatures considerably above the freezing point, and to recall that a deposition of frost requires that the temperature of the top soil, or that of vegetation, be reduced to the freezing point. This, of course, is accomplished by conduction and radiation of heat which takes place more rapidly from the soil and vegetation than it does from the lower stratum of air to the higher.

Anything that will seriously interfere with a rapid loss of heat after nightfall will tend to prevent the formation of frost. Moisture does this, and if the soil be well charged it partakes greatly of the stabilty of water as to temperature, and cools but little, if any, below the temperature of the superincumbent air, and no frost will occur even though all other favorable conditions of clearness, gentle winds and cool air obtain.

Even a small amount of moisture, say one-half inch of rainfall, will give ample protection if well distributed and precipitated within the 24 hours previous. But when severe drouth conditions are prevalent, injurious frosts may occur when the telegraphic temperatures do not show a reading within ten degrees as low as in the first case.

I believe that when estimating the probability or severity of frost sufficient weight has not been given to the dryness or wetness of the soil and the resultant dissipation or conservation of heat, and I call special attention to the point as one of the means for improving the forecast.

I have in mind two typical cases. In the first a high-pressure area attended by clear and cool weather drifted from the westward until it covered the State. No rain had fallen with the passage of the low-pressure area immediately preceding it; hence the ground was in excellent condition for the rapid loss of heat during the night, and a consequent lowering of the temperature of vegetation to the freezing point. Considerable damage was done to cranberries in unflooded marshes. In the second case a high-pressure area of slightly greater weight and slightly lower temperature covered the region about ten days later, but it was preceded within a few hours by a light but well distributed fall of rain, averaging about one-half an inch, and no frost occurred. In both cases the wind was gentle from the northwest, and the nights were clear. With slightly lower air temperature and higher barometer in the second condition, heavier frost would have occurred than in the preceding case had it not been for the thinly spread moisture of the timely rain conserving heat at the surface of the earth.

Might not this principle be carried further in the improvement of the forecast? Assuming that the caloric energy of the sun is a constant factor, the earth receives each year the same amount or intensity of heat, and as the atmosphere is warmed mainly by contact with or radiation from the earth, seasonal variations of temperature which are marked departures from the normal might result from abnormal terrestrial surface conditions with respect to the conservation of this constant solar energy over large continental areas. Here the excessive or deficient rainfall during the preceding seasons should receive careful consideration. The subject is one that requires deeper and more detailed investigation than the length of this paper will permit.

I find that the minimum temperatures in cranberry marshes during abnormally dry seasons often fall 15 degrees below the temperatures telegraphed from the cities and towns within a few miles of the marshes. This is due to the fact that when the loose, spongy peat, of which the marsh is composed to the depth of several feet, has dried out, the radiation of heat during the night is very rapid and is not counterbalanced by conduction and connection from the marsh. The temperature, therefore, in cranberry marshes is at all times much lower than that which obtains in marshes composed of heavy black muck, where it preserves a more equable condition, such as is common to air resting over a considerable body of water. A dry cranberry marsh does not, therefore, enjoy that immunity from frost which wet marshes and watery lands get the benefit of. But when the ditches are flooded from the reserve water supply on receipt of a frost warning, the water quickly percolates through the peat composing the marsh, and the rapid loss of heat by radiation is checked and the frost averted.

The degree of heat to which vegetation has been subjected immediately before the frost condition, and the temperature under which it had made its growth, will in a great measure determine the extent of damage to ensue.

By carefully considering the principles herein enunciated, I will say that in 1894 12 out of 14 official forecasts of frost were fully verified—a much greater percentage of accuracy than has ever been attained by simply considering air conditions alone.

Willis L. Moore,
Chief of U. S. Weather Bureau.

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*SALIX WARDI, BEBB.**

It is desirable to know much more of the range and specific place of this very interesting willow than is yet known. Having visited it the past season in its native habitat during flowering time, May 10th, at Bonneterre, Mo., and again when in mature leaf at Pilot Knob and Irondale, Mo., August 19th–20th, also at Washington, D. C., June 18th, I felt, though not without considerable diffidence, that my observations might prove of interest.

If my observations, in some respects, clash with those of our eminent and acute Mr. Bebb, the fact should be ascribed to variation of, or probably to more complete material.

The S. Wardi extends northward to within about 37 miles of St. Louis in greater or less abundance, intermingled with S. nigra and S. longifolia. One, and but one, I discovered growing on the banks of a lake in the Mississippi bottoms, about 8 miles northeast of St. Louis. Hybrids between the Wardi and nigra occur, but are not common, as is the case with nigra and amygdaloides.†

Though without question specifically distinct from nigra, and seeing it in growth, never to be mistaken for nigra, yet it presents several important characters reminding one, again and again, of the latter. Such are the general shape of the leaves, short petiole, persistent stipules, the staminate aments, number of stamens, scales, capsules, but especially the almost absolute correspondence of venation, also the extension of the flowering laterals beyond the base of the rachis, is but the same character often observed in nigra emphasized. And yet further, the bark, though distinct, has a resemblance to that of the young stems of nigra. Still another reminder of the relationship is the near likeness of discoloration of dried specimens, as well as the color and taste of their infusions.

The following will embrace my observations of its main features: Salix Wardi is either a shrub or tree, usually the latter, which rises to the height of 10–15 feet, or exceptionally to 20 feet, 2 to 7 inches in diameter, spreading top, scraggy branches, tending to curve downwards; twigs tenacious, even as to bases, tips winter-killed; bark of stem and main branches are dark grey or blackish (therefore by the natives called 'black willow'), deeply latticed-ridged, resembling that of a youngish black walnut, intensified; it is lichen-covered on its northern aspect. The stem usually stands single, not in clumps as is common with S. nigra. The leaves vary from long narrow, to shorter oblong or ovate-lanceolate, matching fairly well, in their range, the forms of both nigra and amygdaloides, whitish glaucous beneath, pubescent when young, with short petioles; the bases of the leaves range from acute to auriculate, or cordate; stipules large, persistent, variable, roundish, irregular reniform, rhomboidal, oblong, the upper half often serrate, *glandless*, all obtuse; any tendency of pointing appearing to indicate contamination from nigra; young shoots very leafy, rather heavy, intensely whitish hoary pubescent (mostly); aments long, on many leaved laterals which are prolonged beyond the origin of the rachis; capsules smooth, ovate, ovate-conical, globose-ovate, with firm walls retaining shape in drying, line of suture conspicuously marked, slow to open; style and stigma exceptionally undeveloped, the

* Garden and Forest, Vol. 8, p. 363.

† See writer's 'Relations of Nigra, etc.,' Vol. 6, No. 13, Acad. Sci., St. Louis, Mo.

latter mostly *not notched*. Pedicels stout, long as in amygdaloides. Stamens 4 to 7, mostly 5 to 6, subverticillate, villous at base; scales of staminate as in nigra, short obtuse, villous inside, smooth and *veined* outside.

On the 10th of May about $\frac{1}{3}$ to $\frac{1}{2}$ of the staminate flowers were yet fresh, whilst those of nigra had entirely vanished. They were therefore about 10 days later than nigra, and fully three weeks later than amygdaloides. Some of the capsules were not fully developed, whilst most of nigra had opened.

The discoloration occurring in drying is light or dark brown. The odor given off in handling is strong, rather disagreeable. Many of both staminate and fertile aments were much disfigured and deformed by insect work, or fungous infection. Stamens were caused to look like immature capsules.

Venation: In its very minute reticulation, Wardi presents an almost exact counterpart of nigra; it lacks however the looping and marginal of the latter.* As to surface venation, while some specimens show raised reticulation moderately, as a rule, this is not a prominent feature.

Infusion: making strong infusions of the bark and leaves of each of Wardi, nigra, and amygdaloides, the first resulted in a liquid of slight bitterness, light brown color; the second, of increased bitterness, also brown color; the third of much increased bitterness, black color, the last two were from fresh material.

In comparing my Missouri with my Washington specimens, I find evidence of probable contamination in the latter series. Such are the shorter pedicels, the tendency to the notching of the stigma, and the greater prevalence of the long narrow-leaved forms.

Finally, having examined several speci-

SYNOPTICAL CONSPECTUS OF S. NIGRA, WARDI, AND AMYGDALOIDES, SHOWING RESEMBLANCES AND DIFFERENCES.

SALIX NIGRA.	S. WARDI.	S. AMYGDALOIDES.
Range extended, North and South.	South of 39° latitude	North and West.
Size, tree large. branches crooked, ascending.	Small spreading top	large, straight branches
Stems, in clumps from a common center.	Single,	Single.
bark, young slight ridgy; old flaky	deeply latticed, ridgy	Smooth or roughish
branchlets, very brittle at bases	tenacious	somewhat brittle
branchlets, hardy to tips.	ends, winter-killed	winter-killed
Shoots, moderately pubescent	hoary pubescent	glabrous
leaves, oblong or linear-lanceolate	the same, or broader	ovate-lanceolate
base of leaf, acute to truncate.	acute to auriculate	from acute to cordate
Under surface green	whitish glaucous	pale glaucous
venation, very minute, marginal line	very minute, no marginal	coarser, more regular
petioles, short.	the same	very long
Stipules, pointed, persistent	obtuse, persistent	obtuse, caducous
Stipules non-glandular	non-glandular	*always glandular*
date of blossoming, about April 25th.	May 5th	April 15th
Stamens, mostly less than 6.	4 to 7, mostly 5 or 6	6 to 9
Scales of staminate, short obtuse.	the same	ovate, oblong, acute
Capsules, ovate-conical	ovate, globose-conical	ovate-conical
pedicels, short slender	long, stout	long, stoutish
notched stigma, and style, prominent	both poorly developed	as in nigra
discoloration, brownish,	light or deep brown	dark, ashen or lead color
odor, simply herby	Strong, disagreeable	fls. and shoots fragrant
insects or fungous, none, early,	fls. and frt. deformed	none.
insects on leaves, mite galls	the same	almost free
infusion, bark and leaves, bitterness slight	the same	more decided
infusion, bark and leaves, color, brown	brown	black

*See writer's paper 'Venation of Salix' 5 Rept. Mo. Bot. Gard., p. 52.

mens of S. longipes (now S. occidentalis, Bebb) in herb. Nat. Museum; one, an original type specimen by Rugel at Mo. Bot. Gard.; one from Apalachicola bay, Fla. (by Mohr), I venture to predict that after full investigation, the Wardi and longipes will have to go under the same name. In presence of the very high authority of my friend Bebb, I feel fully conscious of the temerity of such assumption; but, if the boldness of an amateur may stimulate him and others to further efforts to solve the entanglement, a good point, at the least, shall have been made in the interest of science.

On previous page is a synoptical conspectus of S. nigra, Wardi, and amygdaloides, showing by comparison their resemblances and differences.

N. M. Glatfelter.

St. Louis, Mo., Oct. 7, 1895.

SCIENTIFIC NOTES AND NEWS.

EDWARDS' BUTTERFLIES OF NORTH AMERICA.

In the 16th part of his Butterflies of North America, which appeared early in October, Mr. W. H. Edwards has given us one of the most important and interesting of this third series. The three species selected for representation are *Parnassius smintheus*, *Satyrus charon* and *Chionobas gigas*. Every stage of each is represented by the usual wealth and beauty of illustration, which, were we not now accustomed to it, would strike us with amazement, excepting the last species, of which the chrysalis and the last half of the larval life are yet unknown. As to Parnassius, no such illustration of a species of the genus has ever been attempted. This Part is particularly valuable, since Mr. Edwards has enriched his text with abundant observations and field notes from his correspondents, so that Parnassius extends to 16 quarto pages and Chionobas to 11. There is much interesting new matter regarding the formation of the abdominal pouch of the female Parnassius and figures are for the first time given of Scudder's peraplast, the supposed male implement in its formation. The Chionobas portion contains remarkably full comparisons of the habits and distribution of three species of the genus: gigas, californica and iduna, largely from Mr. W. G. Wright's notes, in justification of their belief in the distinctness of these three forms, denied by Elwes.

Another part will presumably conclude the series, but we must express the hope that the indefatigable author will be encouraged by extended subscriptions to begin another series forthwith. Material is not lacking.

THE DAVENPORT ACADEMY OF NATURAL SCIENCES.

The Academy shows signs of increasing activity. It printed, this spring, *A Summary of the Archæology of Iowa*, by Professor Frederick Starr, of the University of Chicago. This pamphlet, of 72 octavo pages, contains a condensed statement of the substance of more than two hundred scattered articles and papers. It forms a foundation for further study. The Academy now plans a thorough and systematic exploration of the archæology of the State and solicits help from all Iowa workers. A circular stating the plan of the work and giving specific directions to collaborators has been printed and is being distributed. The Academy deserves hearty sympathy in this matter. The present condition and future prospects of the Society are most encouraging. With no debt, it owns a good fireproof building, possesses important collections in natural history and an astonishingly valuable material from the mounds, and has a library numbering 40,000 books and pamphlets. Its '*Proceedings*,' now in the sixth volume, are known through the world of science. The continuance of publication is now happily assured by a legacy

of $10,000 just received from Mrs. Mary Putnam Bull, of Tarrytown, N. Y. This gift, a memorial to Mr. Charles E. Putnam and Mr. J. D. Putnam, has been set aside as a Permanent Publication Fund. An effort is now being made to secure an endowment of $50,000. All who know the history of the Academy will wish it success in this undertaking.

GENERAL.

THE Thirteenth Congress of the American Ornithologists' Union will convene in Washington, D. C., on Monday, November 11th, at 8 o'clock P. M. The evening session will be devoted to the election of officers and the transaction of other routine business.

The meetings open to the public, and devoted to the reading and discussion of scientific papers, will be held in the Lecture Hall of the United States National Museum, beginning Tuesday, November 12th, at 11 A. M., and continuing three days. Information regarding the Congress can be had by addressing the Secretary, Mr. John H. Sage, Portland, Conn.

THE Institute of France celebrated its centenary on the 23d, 24th, 25th and 26th of the present month. On the 23d the members of the five Sections met to receive the associates and the French and foreign correspondents. On the 24th there was a general meeting at the Sorbonne at which M. Poincaré, Minister of Public Instruction and of the Fine Arts, made an address, followed by a banquet in the evening. On the 25th there was a *matinée* at the Théâtre Française and a reception at the house of M. Faure, President of the Republic. On the 26th there was a visit to the Castle Chantilly and a reception by M. le duc d'Aumale.

M. DUCLAUX has been elected director and Dr. Roux subdirector of the Pasteur Institute.

M. JANSSEN described before the meeting of the Paris Academy of Sciences on October 7th an ascent to the observatory on Mt. Blanc made on September 28th. The parts of a thirteen-inch telescope have arrived safely on the summit and will be mounted as a polar sidereostat. The self-recording meteorograph had stopped running, and M. Janssen thinks that it will require further experiments before the instrument will give satisfactory records. M. Janssen took advantage of the dry air of the summit to examine the solar light with a spectroscope and failed to find any rays of aqueous origin, and regards it as certain that there is neither oxygen nor aqueous vapor in the solar envelopes.

THE Hopkins Laboratory of the Stanford University has just issued the first of a series of bulletins, being a report on the Fishes of Sinaloa, giving the results of an expedition, under the auspices of the laboratory, by Dr. Jordan and several assistants last winter to the port at Mazatlan. A similar expedition, under charge of Dr. C. H. Gilbert, head of the department of zoölogy, with a force of assistants, will be made in December of this year to the coast of Panama. Other expeditions will be sent out from time to time until the Pacific coast is covered.

AT the recent meeting of the International Congress of Railway and Marine Hygiene, at Amsterdam, Dr. Zwaardemaker, of Utrecht, urged that railway employees should have their sense of hearing as well as their eyesight tested and that applicants for railway service should only be accepted when their sense of hearing is normal. At the same congress an interesting discussion was held as to whether men wearing spectacles may be employed in the railway service. It seems that in parts of Germany defective eyesight may be corrected by spectacles, whereas in other parts those requiring them may not be employed. In Holland men with abnormal vision are not admitted to the railway service, but, if the

eyesight becomes defective later, spectacles are supplied by the company. It was suggested that engineers and firemen who required glasses should not be employed owing to the difficulty of keeping them clean.

Professor Hale, of the University of Chicago, and Professor Keeler, of the Allegheny Observatory, are now in Boston engaged in testing the lenses which Mr. Alvan Clark has now nearly completed for the Yerkes Telescope and which he will perfect under their direction.

Herr Ludwig Dürr, a German civil engineer, has recently exhibited before the military authorities in London a lamp invented and patented by him. The light is originated by automatic evaporation and overheating of the vapors of ordinary petroleum, and is said to yield a light ranging from 3,500 to 14,000 candle power. With it small print could be easily read at a distance of 120 yards. It is stated that the Dürr light has already been extensively adopted by the Russian and German governments.

The Paris Academy of Sciences listened to a curious address by M. Émile Blanchard on October 7th. M. Blanchard stated that Lord Salisbury's presidential address before the Oxford meeting of the British Association confirmed the views he had always held regarding the permanence of species. He said that he had been unable to alter the hereditary color of the wings of butterflies, though he had kept them under colored lights of all the shades of the spectrum, and that he himself had often offered in vain to bring before the Academy the results of any investigator who had produced a new species in the animal kingdom!

Professor Mach, of Vienna, and Professor Wislicenus, of Leipzig, have been elected members of the Kaiserl. Leop-Carol. Akademie deutscher Naturforscher.

Die Accademia dei Lincei, of Rome, has elected H. Wild as foreign member and Ernesto Cæsaro, the mathematician, and Annibale Ricco, the astronomer, as corresponding members.

Mr. Holbrook Cushman, instructor in physics in Columbia College, died on the evening of October 25th from heart disease, at the age of 38.

Dr Thomas Keith, a distinguished London physician, known for his original investigations in ovariotomy and in fibroid growths, died on October 9th in his sixty-ninth year.

We learn from the *Naturwissenschaftliche Rundschau* that Professor Dimitri Brändza, director of the Botanical Gardens in Bukarest, died at Stanicul, Moldau, on August 15th. Dr. Riva, the botanist and African explorer, died in Rome on August 24th. On September 4th Professor Dr. Hellriegel, director of the agricultural experiment station, died at Bernberg, at the age of 64 years. On October 1st died Dr. Gustav Wilhelm, professor of agriculture in the technical high school of Gratz, at the age of 61 years, and Dr. Ernst von Rebeur-Paschwitz, astronomer and Privatdocent at Halle, at the age of 34 years.

UNIVERSITY AND EDUCATIONAL NEWS.

ANNUAL REPORT OF PRESIDENT LOW OF COLUMBIA COLLEGE.

President Low's report was presented to the Trustees of the College on October 7th, and will shortly be published. From it we take the following facts concerning the progress of the University.

Undoubtedly the most important events in the history of the University are those relating to its removal to the new site. Of these events President Low's own gift of a million dollars for the Library Building as a memorial of his father, though only incidentally mentioned in the report, is the most noteworthy. A building for the Depart-

ments of Natural Science has been given by Mr. Schermerhorn, but at least six other buildings are needed. Much work has already been done on the new grounds, and the autumn of 1897 has been fixed as the time when the University shall remove to its permanent home.

The College of Physicians and Surgeons (School of Medicine of the University) will remain at its present site, and the buildings have been enlarged at a cost of $600,000.

During the year 24,839 bound volumes have been added to the Library, making the total number of books over 200,000. More than $25,000 was contributed during the year for the purchase of books in addition to special gifts.

Thirty University scholarships of the value of $150 each have been established for graduate students. In connection with President Low's gift and at his request eight University scholarships and a University fellowship were established. Twenty scholarships are also to be maintained by the Trustees in Barnard College, and the Trustees at their own motion established a professorship to be known as the 'Seth Low Professorship of American History.'

The increase in the number of students in the University continues. The total number of students was

1891–92	1573
1892–93	1641
1893–94	1805
1894–95	1943

Of these 649 already held degrees representing 136 American and 26 foreign institutions. There were in the School of Philosophy 95 graduate students, in the School of Pure Science 34 and in the School of Political Science 94, and in addition students in the Senior Class of the School of Arts attend these schools.

The total number of instructors was 265, of whom 53 were professors, 8 emeritus professors and 15 adjunct professors. The most important addition to the School of Pure Science was the appointment as professor of mathematics, under an arrangement with Barnard College, of Professor Frank D. Cole, from the University of Michigan.

The report lays especial stress on the importance of a liberal training as a foundation for professional education. In discussing this question President Low writes:

> "Men cannot afford to postpone their specializing in study until so late in life as twenty-two or twenty-three years of age. In England and Germany they begin to specialize at nineteen and twenty, and they ought to do so here. In the newer country it is harder, not easier, to postpone the actual duties of life. It is in this light that I interpret the recent proposition from Harvard to give the Bachelor of Arts degree in three years, and it is certainly in this light that our own action is to be understood of permitting our college Seniors to study under any of the university faculties. Our Freshman Class at Columbia averages at entrance a little above seventeen years of age. * * * * But now that the university has appeared in this country as a place for specialization ideally to be founded on a previous liberal training, it is clear that the liberal training must either be omitted altogether or be confined to those years to which it properly belongs. These years I conceive to be broadly from sixteen to twenty."

President Low is justified in reporting "for the University a year of vigorous, inspiring life, whether regard be had to the current activities of the year, or to the progress made in laying the foundations of the University upon the new site."

GENERAL.

THERE have been two additions of importance to the Stanford Faculty for this year. Dr. H. H. Powers, of the department of economics in Smith College, appointed to the chair of economics and social science; Prof. F. J. A. Davidson, of Toronto University, to the assistant professorship of Romanic languages; the latter appointment being to fill the vacancy made by the resignation of Prof. W. S. Symington, Jr., who takes a professorship in Amherst. Dr. Henry C. Meyrs, instructer in chemistry,

resigned to take a professorship in chemistry in Washington State University, to which institution Dr. M. W. Harrington, late of the Weather Bureau, has been called as President, and Mr. Harry Landes, A. M., of Harvard University, to the professorship of Geology.

It has been incorrectly reported in several journals that the University of California will be moved from Berkeley to San Francisco. Mayor Sutro has given 13 acres of ground in San Francisco and the State Legislature has appropriated $250,000 for the erection of buildings, but these are for the professional schools of law, medicine, dentistry, pharmacy and art, which have always been located in San Francisco.

Mrs. Cornelia A. Atwill has given $6,000 to Columbia College for the foundation of two scholarships, to be known as the Stuart Scholarships in the school of arts, in memory of her grandsons, S. B. Stuart, Class of 1880, E. T. Stuart, Class of 1881, both of whom have since died. Mrs. Atwill reserves the privilege of nominating the scholars if so disposed, during her lifetime.

President Peter McVicar has resigned the Presidency of Washburn College, Topeka, Kans., which position he has held since 1871.

The British Treasury has offered to include in next year's estimates a grant of £20,000 to the University College of South Wales. Cardiff and the Drapers company have offered to subscribe £10,000, provided that similar amounts are collected locally.

Among recent foreign appointments we notice that Dr. Dogiel, professor of anatomy in the University of Tomsk, has been called to the University of St. Petersburg, and Dr. J. P. Kuenen has been called to the new Harris chair of physics in University College, Dundee. Dr. F. Marés has been promoted to the professorship of physiology at the Bohemian University of Prague and Dr. Schuchardt has been appointed to a newly established chair of psychiatry at Rostock.

The Williams Science Hall given to the University of Vermont by Dr. E. H. Williams, of Philadelphia, at a cost of $13,000 is now nearing completion. It contains laboratories and lecture rooms for the departments of chemistry, physics, biology and electrical engineering. The present Freshman Class, 78 in number, is the largest in the history of the University.

From the Oxford University Gazette of October 11th giving the courses for the Michelmas term, it appears that in mathematics, astronomy and mechanics lectures are given occupying together twelve hours per week; in physics four hours per week; in chemistry eleven hours; in comparative anatomy two hours or more; in physiology five hours; in botany six hours; in geology six hours; in rural economy two hours; in zoölogy two hours, and in anthropology one hour. Laboratory work is offered in connection with most of these courses, but the opportunities for scientific study at Oxford do not seem to be so favorable as at the leading German and American universities.

CORRESPONDENCE.

THE PROBLEM OF SOLAR MAGNETISM.

The work of Professor Bigelow (Science, p. 509, October 18, 1895) upon this subject has reached such dimensions as to command attention; at the same time the conclusions require the abandonment of so many ideas which experimental physicists have considered as representing experimental facts that I venture to call attention to some of the points which will render the new theory difficult of acceptance, by some at least. If Professor Bigelow has forseen and quantitatively explained away these difficulties we ought to have the explanations.

If meteorology has contented itself (p. 510) with only a consideration of combinations of 'earth's gravity, earth's rotation and equa-

torial insolation,' and has treated the whole question of insolation, it seems to me to have considered, in the last factor, the most important source of energy for disturbances of the atmosphere. We receive from the sun daily sufficient radiant energy to melt a sheet of ice six inches thick (180 ft. annually, Langley). Two-thirds of this is caught by the atmosphere. either on its way in or out. A rough calculation shows this energy sufficient to raise the temperature of the entire atmosphere a little over 3° C. daily. When we remember that this action is concentrated upon a portion of the atmosphere, which is changing daily and annually, and upon certain strata, depending upon their relative humidity, it seems almost superfluous to seek for other forms of energy to account for the activities of the air.

The keystone of the new theory seems to be the assumption that the sun is a magnet and its activity as such affects us to a marked extent. The ratio of the sun's diameter to its distance from the earth is about 1 to 100. It is almost inconceivable that the best steel ball magnet one foot in diameter would affect the most delicate instrument at a distance of 100 feet. Possibly an electromagnet might, but how shall we conceive the sun as an electromagnet, even with the assumption of a solid nucleus and distant envelope. No trace of permanent magnetism has ever been observed in a body that is within several thousand degrees of the sun's temperature; magnetic effects vanish at 800° to 1000° C., except those due to electric currents. Suppose the sun to be a magnet, any distribution of magnetism at all adapted to the new theory would give a field at our distance homogeneous in its distribution in solar longitude, and hence the axial rotation of the sun would not affect the earth's magnetic state; this would be done only by variations from time to time in the intensity or distribution of the sun's magnetism. In no case can the earth's total magnetization be due to the sun's field. It is far too weak to induce such intensity even in the most susceptible metal, much less in such non-magnetic material as the earth's crust. Furthermore, if such were the case the magnetic poles would pass round the earth daily, somewhere between latitudes 60° and 75°.

It would appear that Professor Bigelow attributes to magnetic lines of force entirely novel properties. Properly speaking, lines of force are directions only, and if electricians refer to them as containing energy they really mean tubes of force.

There can be no radiation along a line or tube of force. When the author speaks of the sun as a 'magnet in dynamic operation,' and 'live lines of magnetic force originating in the sun and propagated to the earth in wide sweeping curves,' he uses terms to which students of mechanics and physics have fixed definite meanings, but in a way quite unintelligible to them. Also when variations of terrestrial latitude are attributed 'to the action of stresses in the ether at the surface of the earth, due to the mechanical forces generated in the ether by the transmission of radiant energy.' If we are to admit a new form of radiant energy we must have good cause indeed. No doubt we receive from the sun radiant energy of wave-lengths varying from fractions of a micron to possibly many kilometers, and this varies in nature from actinic to electric, from light to Herz waves of gigantic size.

Again, with reference to the reversal of the curves, Professor Bigelow's magnetic theory seems incapable of explaining such a phenomenon. To doubt that a line of magnetic force is continuous from one pole to the other, in fact, is a closed curve, is to doubt the most fundamental principle of magnetism as at present experimentally established. Electrostatic tubes, or lines of force may be open curves, but the difference between the two cases must be evident. It is difficult to see the connection between these hypothetical magnetic phenomena and the temperature of our atmosphere. It is too permeable and too bad a conductor to catch much of the slow radiant energy, either magnetic or electric.

In view of these difficulties among others are we not warranted in asking a fuller justification of a hypothesis, seemingly based upon curves of small residuals, obtained by a delicate and apparently complicated system of selecting and plotting.

WM. HALLOCK.

COLUMBIA COLLEGE, October 24, 1895.

SCIENCE OR POETRY.

EDITOR OF SCIENCE: In your issue of October 4th, p. 437, under the title, 'Science or Poetry" there is discussed the soundness of the scientific views of three Americans. Referring to one he quotes from his address in SCIENCE, August 23, p. 210, "It can be stated without fear of refutation that every physiological investigation shows with accumulating emphasis that the manifestations of living matter are not explicable with only the forces of dead matter," and he adds, p. 438, "The assertion that this is shown by every or by any physiological investigation is flatly contradicted by most of the investigators." On p. 439 the evidence is called for. I have selected from investigations on what in general comes under the term Osmosis (diffusion, absorption, transudation, etc.), a few references to recent work. This branch of physiology has been chosen for it is in this that the stronghold of the mechanical physiologists may be found. The questions are sharply defined also and experiments may be made on precisely the same object, both in the living and in the dead condition.

Heidenhain, R.: Versuche und Fragen zur Lehre der Lymphbildung. Arch. f. d. gesammte Physiolgie des Menschen u. der Thiere (Pflüger's Archiv.) Bd. 49, 1891, pp. 209–301. In his conclusions he says: "Da die Triebkraft nicht in dem Blutdrucke liegen kann, muss dieselbe ihren Ursprung aus den Capillarwandung selbst herleiten; es handelt sich um Secretion, nicht um Filtration."

Reid, W.: Osmosis experiments with living and dead membranes. Journal of Physiology, Vol. XI., pp. 312–351.

It is shown that the dead differed markedly from the live membranes. With the living membranes the osmosis is more like the secretion of a gland.

Starling, E. A. and Tubby, A. H.: On absorption from and secretion into serous cavities. Journal of Physiology, Vol. XVI., 1894, pp, 140-155. "Absorption from or secretion into the pleural cavities is not a mere question of osmosis." Conclusions, p. 151.

Chittenden, R. H.: On digestive proteolysis, being the Cartwright lectures for 1894. New Haven, 1895, p. 116. "The view once held, that the rate of absorption from the alimentary tract stands in close relation to the diffusibility of the products formed, and that non-diffusible substances are incapable of absorption, is no longer tenable. Absorption from the intestine is to be considered rather as a process involving the vital activity of the epithelial cells of the intestinal mucous membrane, where chemical affinities and other like factors play an important part in determining the rate and order of transference through the intestinal walls into the blood and lymph."

Howell, W. H.: The Physiology of Secretion. The Reference Handbook of the Medical Sciences, Vol. VI., pp. 363–379. "If the living lung tissue that allowed no liquid to filter through it was killed by heat or any other means, filtration quickly commenced. Similar results were obtained with the frog's intestines and abdominal wall; and if we were justified in applying these results to the other membranes of the body, it would be necessary to explain transudations by something more than simple physical laws." * * * After speaking of some other facts he continues: "Investigations like this compel us to be cautious in explaining the simplest phenomenon of the animal body by physical laws obtained by the study of dead matter."

In the experiments the structure remains the same, and consequently if the results differ the difference cannot be deduced from structure, for the only difference, so far as can be determined, is that it is alive during one experiment and dead at another. If it is urged that the difference is still due to structure which is different in the dead membrane, then life made the difference and there is no ground for disagreement.

In preparing the address it was supposed that a moderate amount of scientific restraint was exercised, and among other qualifications it is stated in the paragraph preceding the one quoted by the critic that, "In brief, it seems to me that the present state of physical and physiological knowledge warrants the assumption, the working hypothesis, that life is a form of energy different from those considered in the domain of physics and chemistry. . . . It, like the other forms of energy, requires a ma-

terial vehicle through which to act. . . . Like the other energies of nature, it does not act alone, etc."

The critic says, p. 439: "Recent utterances seem to show that all the criminals are not among the materialists, and that the dogmatism of biologists must be attacked at both ends of the line."

"In all seriousness we ask, what can fundamental disagreement among those who speak with authority lead to except disaster? Are we not bound to find first principles which will command the assent of all thinking men?"

I supposed it was an axiomatic truth that to have agreement only one man must do the thinking. However, progress has not been most rapid under such circumstances in the past. Perhaps, after all, the best possible antidote to the whole criticism of *Science or Poetry* is the review of Haeckel's Monism, entitled 'The tyranny of the monistic creed' (SCIENCE, N. S., Vol. I., p. 382). There seems in this review to be a protest against any one man setting up as the sole possessor of true doctrine. Here is one sentence from the review: "He (Haeckel) tells us all eminent and unprejudiced men of science who have the courage of their opinions think as he does." As the reviewer did not take kindly to this tyranny of monism, perhaps Haeckel would not include him among the elect in science, but rather would count him also among the poets.

S. H. GAGE.

CORNELL UNIVERSITY.

THE KATYDID'S ORCHESTRA.

TO THE EDITOR OF SCIENCE: The letter in the September 20th issue, from Mr. George M. Gould, seems to indicate that there is considerable ignorance concerning what are supposed to be elementary facts in entomology; and further, that the letter was not submitted to Mr. Scudder, the Entomological Editor, who is well posted in this matter. Mr. Gould asks, "Is Company A composed of males and Company B of females?" The solution suggested is an impossible one, because throughout the *Orthoptera* the females are mute and only the males are provided with stridulating organs. Furthermore, in speaking of the 'Katydid,' Mr. Gould seems not to be aware that we have at least a dozen species to which this name is applied. We have *the* 'Katydid' which is *Cyrtophyllum concavum*, which is most generally described, and which makes the typical 'Ka-ty-did' or 'Ka-ty-did'-nt' sound. This species, I believe, does not occur in North Carolina, and the insect to whose sound Mr. Gould has listened was quite a different species from the one that makes loud music in the Middle and Eastern States. The members of the genera *Microcentrum*, *Scudderia* and *Amblycorypha* are all 'Katydids,' all musicians, and each species has a different note. Some of the sounds made by the Locustidæ have been described and set to music by Mr. Scudder, and as a matter of fact every collector in this order soon learns to know, with a fair degree of certainty, exactly what species is making the sound. Mr. Gould's observations are interesting; but they will have very little value until we know of what species he speaks. It is quite certain that the true 'Katydid' is not the species intended.

JOHN B. SMITH.

RUTGERS COLLEGE, NEW BRUNSWICK, N. J.,
October 14, 1895.

Professor Smith is of course correct in taking Dr. Gould to task for suggesting that the female katydid may stridulate, but it is not by any means so sure that Cyrtophyllus (the true katydid) 'does not occur in North Carolina,' as believed by him; on the contrary it is at least highly probable that it does, for it is not only found 'in the middle and eastern States,' as he says, but has also been reported from Kentucky (Garman), South Carolina (Saussure) and Georgia (Brunner), as well as in the West from Illinois to Texas. Professor Smith speaks as if the other genera he mentions (which are *erroneously* called katydids) belonged in the same group with Cyrtophyllus, whereas the last belongs to a different family (Pseudophyllidæ) and is indeed interesting as the only genus of that family yet known in the United States, although the family is richly represented in Central and especially South America.

The antiphonal rhythm of the two 'orchestras' mentioned by Dr. Gould is very interesting and not altogether unlike what has been observed among crickets; but I am inclined to doubt the

reality of the asserted difference in pitch, because with these locustarians, at least to an untrained ear like mine, differences in distance and consequent sharpness of tone (which latter Dr. Gould specifically mentions) are accompanied by an apparent difference in pitch, which is lost on similar approximation. If Dr. Gould can find two choirs equally loud and distinct, or equally distant and free from intermediate obstructions, accompanied by a real difference in pitch, he should report his further investigations, and further determine precisely what insect is the source of the orchestration.

SAMUEL H. SCUDDER.

A NATURALIST IN MEXICO.

THERE has recently appeared a small volume by Mr. F. C. Baker under the above title which purports to be an account of the expedition of Yucatan and southern Mexico sent out by the Academy of Natural Sciences of Philadelphia in 1890, under the leadership of Prof. Angelo Heilprin. It is based presumably upon the author's notes and recollections of the trip.

As a member of this expedition I consider it my duty to correct several inaccuracies in Mr. Baker's statements, and especially to call attention to the manner in which quotations have been made from the scientific reports of the expedition and other works without a word as to the source of the information, leaving the reader to infer that it is the work of the author. In the preface it is true we are referred to the Proceedings, Acad. Nat. Sci. Phila., 1890–95, 'for full accounts concerning the scientific portion of the expedition,' but the author does not acknowledge any assistance from this source in preparing his volume and makes direct quotations without the slightest comment. His historic account of Yucatan is drawn from Stephens' 'Incidents of Travels in Yucatan,' Vol. I., Chap. iii., as a comparison will at once show, many of the phrases being identical.

Turning to page 80 of 'A Naturalist in Mexico,' we find an account of previous measurements of Mt. Orizaba. The source of this can easily be ascertained by referring to Prof. Heilprin's paper on the subject Proc. Acad. Nat. Sci. Phila., 1890, p. 253–254, as the following quotations will show:

BAKER.	HEILPRIN.
In 1796 Ferrer, by means of angle measurements taken from the Encero, determined the height to be 17,879 feet. Humboldt a few years later measured the mountain from a plain, near the town of Jalapa, and obtained 17,375 feet. He observed, however, that his angles of elevation were very small, and the base-line difficult to level, etc.	Ferrer in 1796, by means of angle measurements taken from the Encero, determined its height to be 17,879 feet. Humboldt a few years later measured the mountain from a plain near the town of Jalapa, and obtained only 17,375 feet, but he observes with characteristic caution that his "angles of elevation were very small, and the base-line difficult to level," etc.

Professor Heilprin very properly places Humboldt's statement in quotation marks, and refers in a footnote to his source of information. Mr. Baker, however, takes Heilprin's statement bodily and Humboldt's with it and uses no quotation marks nor reference whatever! The rest of the account is similar to the above example, but Mr. Baker unfortunately credits Dr. Kaska with making his measurements with a 'thermometer' instead of a barometer as stated by Professor Heilprin.

Immediately following the consideration of the height of the mountain Mr. Baker gives us an account of the birds observed at San Andres. This he has taken directly from my paper Proc. A. N. S., Phila, 1890., p. 213, though it is presented without any acknowledgment or marks of quotation. The following example is sufficient:

BAKER.	STONE.
The difference between the birds of San Andres and those of Orizaba 4,000 feet below, was marked. Only three species were common to both localities. Nearly all the species belonged to northern genera. In the town the only birds observed were the House Finch, Blue Grosbeak and Barn Swallow, etc.	The difference between the birds of this vicinity and of the town of Orizaba 4,000 feet below, was at once apparent. Only three species were seen at both places. * * * Nearly all the species belonged to more northern genera. * * * In the town itself the only birds observed were the House Finch, Barn Swallow and Blue Grosbeak, etc.

While accompanying the expedition mainly as a conchologist, Mr. Baker did render valuable assistance in collecting birds. The scien-

tific names of the species, however, were at that time unknown to both of us, and the subsequent identification, after our return, was entirely my own work. Mr. Baker, however, has quoted my notes and identifications throughout his book as if they were his own. In many cases he has supplemented them by original notes which must have been drawn from memory—a very unreliable source after a lapse of five years. For instance, on p. 28, he says 'finches were quite abundant,' while they were in reality very scarce, and p. 32 he records 'thrushes' at Glenn's Camp, while we only saw one thrush in Yucatan, which was at another time and place.

Strangest of all, however, is his account of the Trogon. The bird was shot in the cactus thicket, under the circumstances which he describes, was a Motmot and not a Trogon, as my notebook shows, and the only Trogon that we did collect—in fact, the only one we saw—had not a 'rose-colored breast,' but was the *yellow* breasted *T. caligatus*.

In describing the effects of the rarefied air during our ascent of Orizaba, Mr. Baker says: "I was seized with most violent symptoms. My head swam, my eyes became bloodshot. * * * * Another of my companions was affected in the same manner." As Mr. Baker and I were together when we desisted in the ascent I must be the one to whom he alludes, and I can only say that for my part the account is grossly exaggerated, nor did I see such signs of distress in my companion. Indeed, Mr. Baker's recollections of the trip seem in many respects very dim, as the opening paragraph of his book shows that he has forgotten the name of the vessel upon which we sailed from New York.

On page 97 Mr. Baker takes occasion to ridicule the naming of the mollusks in the Mexican National Museum, referring to one instance as a 'most ludicrous error.' There is an old saying that "people who live in glass houses should not throw stones," and it seems equally 'ludicrous' to find on page 123 of Mr. Baker's book a figure of our eastern kingbird (*Tyrannus tyrannus*) labelled *T. vociferus;* the white tail-band, which is characteristic of the eastern bird and absent in the other, being brought out prominently in the cut; and yet this figure was drawn by the author especially for this work.

It may seem scarcely worth while to call attention to Mr. Baker's plagiarism as I have done, but unfortunately this is not his first offense, as can be seen on comparing his article on the Round-tailed Muskrat, Proc. Acad. Nat. Sci. Phila., 1889, p. 271, with Mr. F. M. Chapman's earlier paper on the same subject, Bull. Amer. Mus. Nat. Hist., Vol. II., p. 119, and it seems only right that such practice should be exposed.

WITMER STONE.

ACADEMY NAT. SCIENCES PHILA.

SHELLS AS IMPLEMENTS.

PROFESSOR OTIS T. MASON calls attention, in SCIENCE, October 11, 1895, to an illustration of a perforated shell, said to have been used as a scraper, given in von den Steinen's work on 'The Natives of Central Brazil,' and resembling those figured by Holmes in his 'Art in Shell,' Pls. xxvi., fig. 3: xxvii., fig. 1. In shell heaps on the shores of Frenchman's Bay, Mt. Desert Island, I have found numerous valves of the *Mya arenaria* similarly perforated. The greater part seem to have been so pierced by the hard beaks of the common crow, like those found now on beaches. Others, however, show such a rounded perforation as can only have been made by man, and have the edge artificially smoothed. I have always supposed that such smoothing was caused either by the lashing to it, or the insertion, of a wooden handle, and that the object was used as a spoon or ladle. This seems to be corroborated by the circumstance that the inside of one of these shells is covered by a hard incrustation resembling what is often found upon fragments of pottery vessels that have been used as cooking utensils. The edges of the shells show no indication that they have been used as scrapers.

HENRY W. HAYNES.

BOSTON, October 16, 1895.

SCIENTIFIC LITERATURE.

Canyons of the Colorado. By J. W. POWELL, PH. D., LL. D., formerly Director of the United States Geological Survey, member of the National Academy of Sciences, etc., etc. Meadville, Pa., Flood & Vincent, The Chautauqua-Century Press. 1895.

This is a sumptuous volume of 400 quarto

pages, illustrated by over 300 pictures, besides a number of folding panoramas, not paged. It contains fifteen chapters, of which the first four ('The Valley of the Colorado,' 'Mesas and Buttes,' 'Mountains and Plateaus,' 'Cliffs and Terraces') constitute an introduction in the form of a general description of the region traversed by Colorado River. Seven chapters are devoted to the itinerary of the memorable exploration of the canyon in 1869; four chapters contain the itinerary of the supplementary explorations in 1870; and the final chapter is a summary description of the canyon. The introductory and concluding chapters are based on present knowledge of the geography, geology, meteorology and ethnology of the region; the itineraries are also brought up to date, where there is need, by explanatory paragraphs, and while they are in part reprinted from official and other reports they are enriched by extracts from the original journals not hitherto published.

The valley of the Colorado extends from near Yellowstone Park to the Gulf of California, and from the deserts of the Great Basin to the Rocky Mountain front; it is one of the five principal river basins of the United States and bordering territory. It comprises the low-lying desert plains of the far Southwest, the western slope of the main continental divide and the rugged ranges beyond, together with the vast system of plateaus and mesas lying between mountain and desert. In much of this region the 'great stone book' in which the history of the earth is recorded lies open, and the broad expanse of its rocky pages is the paradise of the geologist; throughout much of the region, too, geologic process is so rapid as to catch the eye of the wayfarer and impress the lessons of dynamic geology. Here it was that Powell perceived the significance of the baselevel, and thereby planted the germ of geomorphy—the 'New Geology,' by which the field of the science has been doubled; here, too, he discovered that the high mountain is the young mountain, and that the crust of the earth is responsive to the transfer of load; here, also, other comprehensive generalizations were made whereby the science of the earth was stimulated and raised to a higher plane. Other American geologists, as well as Powell, have gained inspiration in this fortunately conditioned field. Gilbert's concepts became masterly as he traversed the rocky tables and rested in the shadow of the cliffs of the Colorado country, and his memoir on the Henry mountain is still the model geologic monograph; Dutton's magnificent generalizations, of which some are even yet hardly grasped by his contemporaries and followers, were formulated in the same inspiring field; there it was, too, that Holmes developed the genius under which art and earth-science were joined, and his portraiture of plateau and mesa and of cliff and canyon (reproduced in part in the present work) remains a model; it was in the depths of the same canyon that Walcott coördinated paleontology and stratigraphy more perfectly than before, and shaped the ideas now bearing fruit in the policy of the federal survey. Through these students and others the influence of the field was spread over the country and world. Thus the valley of the Colorado is classic ground for the geologist; and with respect to physical geology at least, no other part of the earth has contributed so much to the body of the science.

This is the region which is appreciatively yet succinctly described by its original explorer and most philosophic student in the introductory chapters of his book. The description is at the same time sufficiently popular to be followed by the layman, and sufficiently profound to set forth the principles of the science in considerable fullness; and the chapters accordingly serve the double purpose of depicting the salient features of an interesting region in attractive word painting, and of popularizing newly established principles. Perhaps this part of the book might have been made more useful to students by pointing out the extent to which the principles were developed in the field described; but this is only one of the examples, in which the book abounds, of the elevation of well considered facts and principles above the ego.

The valley of the Colorado is hardly less notable in its aboriginal population than in its geologic features. Within its confines the primitive Shoshoni, embracing the 'Diggers' of early explorers, the warlike Apache, the peaceful

Pima, the mystery-loving Pueblo Indians, and other interesting tribes are found, while ruins of cliff houses, cavate dwellings, and plains villages abound. The living Indians discovered by the explorer spoke divers tongues; their habits of life and social customs were diverse; they had ceremonials, beliefs, systems of philosophy, many in number yet more or less closely related among one another, and so widely diverse from those of civilized men as to be rarely understood; their arts were varied yet related, and sometimes different from, though related to, those represented in the prehistoric relics; and the traditions of the tribes indicated extended migrations, peaceful possession alternating with savage strife, and successive occupancy of various districts by different tribes in prehistoric as well as in early historic times.

Thus the ethnic problems were many and interesting, and, since the inhospitality of the district retarded white invasion, the opportunities for ethnic research were exceptionally favorable. Impressed by the characteristics of the native races, the pioneer explorer began studying and recording the native languages, and this line of research was subsequently continued in connection with the federal survey of the Rocky mountain region and still later in the Bureau of American Ethnology; and the study finally grew into a classification of the native races of America north of Mexico on a linguistic basis. Moreover, collaborators were enlisted in the ethnic work as in the geologic studies, and some of these found inspiration in the same district; the Stevensons, husband and wife, enriched the National Museum with collections from different native tribes, and afterward elucidated the mythology of some of the Pueblo peoples; the Mindeleff brothers made extended and fruitful archeologic surveys; Cushing affiliated with the devout Zuñi priesthood, and brilliantly interpreted their thaumaturgic rites and their curiously complicated symbolism and ceremonial; and the influence of the ethnologists, like that of the geologists, extended over the country and the world. Thus the valley of the Colorado is classic ground for the ethnologist, and the dust of the flower bloomed in the desert has fertilized all other branches of the growing science of man.

In his introductory chapters Powell describes the native tribes and illustrates their characteristics and handiwork as they are known in the light of the science developed in the district, while the itinerary depicts them as they were when first seen by white men. In the description the tribesmen are not dissevered from the district, but treated as an integral part of a natural assemblage of features, like the distinctive flora and fauna—for few of the historic Indians rose to the control of nature, and most of the tribes closely reflected their environment in their habits and institutions. Except that characteristic myths are introduced in the itineraries and that a large number of illustrations pertain to primitive artisans and their art, ethnology is kept somewhat in the background throughout the work, though the ethnology and archeology of the region are happily characterized here and there, particularly toward the end of the fourth chapter.

The itinerary of the first descent of the red-tinted river is a simple narrative of daily events, jotted down by a busy and hard-worked explorer, yet the events collectively form the most remarkable chapter in the history of American exploration; for the writer, albeit buffeted by waves and worn by anxiety for his companions, albeit weary, hungry, drenched and chilled as he wrote, was still a poet-naturalist; and to those who appreciate thrilling adventure, or direct contact with and conquest over nature, the pages are among the most attractive in our language. The little party embarked May 24, 1869, at Green River City, on a river reputed among whites and Indians as too swift and turbulent for passage. Nearly every day was one of peril; oars were broken in the fierce current, boats were overturned in the rapids and crushed against the rocks, apparatus and clothing were swallowed by the waters, food supplies were spoiled and lost, and still the cataracts grew higher, the rapids more terrific; again and again the rushing waters overcame the strength and skill of the boatmen, and the little vessels were engulfed in raging cataracts, sucked down in whirlpools, or rolled over and over on the jagged rocks; once and again leader and men

were washed from their boats to be barely rescued and resuscitated by their mates; yet day after day, for more than three months, the fleet pushed on. The party was a picked one from among the hardiest of frontiersmen, and the record of their coolness, courage and fidelity through ceaseless toil and in the face of hourly peril is a picture of the nobility of manhood done in strong colors. But at last the expedition reaches a roaring cataract more forbidding than those already passed, and at the sight of it the spirit of the senior boatman is broken; he and others regard it as certain death to attempt the passage, and decide to trust themselves rather to the inhospitable deserts. There is no mutiny—the situation is far too desperate—all are alike in the valley of the shadow; but all night long the leader paces up and down a little path on a few yards of sand beach by the river side, weighing the chances. At daybreak he decides to go on, and secures anew the wavering allegiance of one after another of the party; but three will not be persuaded, and set out over the rocks—to their death. The leader, with his five companions, shoots the cataract more easily than anticipated, and three days later reaches the mouth of the Rio Virgen, with friendly pioneers already on the lookout for their wreckage.

In his preface the author says, 'The exploration was not made for adventure, but purely for scientific purposes, geographic and geologic, and I had no intention of writing an account of it, but only of recording the scientific results;' and although the chapters are of thrilling interest as a record of adventure alone, yet from beginning to end of the adventurous expedition the primary purpose was kept in view; directions and distances were platted and checked by sextant observations that the river might be mapped; the rocks were studied that the geologic history of resources of the province might be made known; the turbulent stream was studied as a geologic agent, and the effects of storms, tributaries, and changes in declivity were examined to the end that the processes of river work might be better understood. Despite the severity of the trip, few days passed without the record of important scientific observations or generalizations.

The final chapter describes the Grand Canyon as a geographic feature, as a record of geologic product and process, and as one of the most impressive scenic features of the world. "The Grand Canyon is a gorge 217 miles in length, through which flows a great river with many storm-born tributaries. It has a winding way, as rivers are wont to have. Its banks are vast structures of adamant, piled up in forms rarely seen in the mountains" (page 379). The author's impressions of the gorge as a scenic feature are best expressed in his own words:

"The wonders of the Grand Canyon cannot be adequately represented in symbols of speech, nor by speech itself. The resources of the graphic art are taxed beyond their powers in attempting to portray its features. Language and illustration combined must fail. The elements that unite to make the Grand Canyon the most sublime spectacle in nature are multifarious and exceedingly diverse. The Cyclopean forms which result from the sculpture of tempests through ages too long for man to compute, are wrought into endless details, to describe which would be a task equal in magnitude to that of describing the stars of the heavens or the multitudinous beauties of the forest with its traceries of foliage presented by oak and pine and poplar, by beech and linden and hawthorn, by tulip and lily and rose, and by fern and moss and lichen. Besides the elements of form, there are elements of color, for here the colors of the heavens are rivaled by the colors of the rocks. The rainbow is not more replete with hues. But form and color do not exhaust all the divine qualities of the Grand Canyon. It is the land of music. The river thunders in perpetual roar, swelling in floods of music when the storm gods play upon the rocks and fading away in soft and low murmurs when the infinite blue of heaven is unveiled. With the melody of the great tide rising and falling, swelling and vanishing forever, other melodies are heard in the gorges of the lateral canyons, while the waters plunge in the rapids among the rocks or leap in great cataracts. Thus the Grand Canyon is a land of song. Mountains of music swell in the rivers, hills of music billow in the creeks, and meadows of music murmur in the rills that ripple over the rocks. Altogether it is a symphony of multitudinous melodies. All this is the music of waters. The adamant foundations of the earth have been wrought into a sublime harp, upon which the clouds of the heavens play with mighty tempests or with gentle showers.

"The glories and the beauties of form, color and sound unite in the Grand Canyon—forms unrivaled

even by the mountains, colors that vie with sunsets, and sounds that span the diapason from tempest to tinkling raindrop, from cataract to bubbling fountain. But more, it is a vast district of country. Were it a valley plain it would make a State. It can be seen only in parts from hour to hour and from day to day and from week to week and from month to month. A year scarcely suffices to see it all. It has infinite variety, and no part is ever duplicated. Its colors, though many and complex, at any instant change with the ascending and declining sun; lights and shadows appear and vanish with the passing clouds, and the changing seasons mark their passage in changing colors. You cannot see the Grand Canyon in one view, as if it were a changeless spectacle from which a curtain might be lifted, but to see it you have to toil from month to month through its labyrinths. It is a region more difficult to traverse than the Alps or the Himalayas, but if strength and courage are sufficient for the task, by a year's toil a concept of sublimity can be obtained, never again to be equaled on the hither side of Paradise."

Considered as a whole, the book is a monograph on a region classic in geology and ethnology, and a summary history of the development of science in this region. It is at the same time a record, unique in its fullness, of a memorable exploratory trip, the most arduous, save that of Francisco Pizarro on the headwaters of the Amazon, in the annals of America, and one saved from the verdict of foolhardiness only by success. No geologic or ethnologic library or collection of Americana will be complete without it. As a historical treatise the work might have been made more valuable by setting forth the origin and development of great generalizations, and tracing the growth of knowledge concerning the region and its various aspects, though by such treatment its simplicity and unity would have been impaired.

From preface to summary the pages teem with matter-of-fact reason, mingled with poetic imagery, expressed in clear and fluent language. The strong personality of the author can be read only between the lines of scientific observation or generalization, or of the narrative of patient and persevering mastery of natural forces in the canyon. Reading between the lines, the philosophy of the author may be recognized in its practical application. He explored the canyon to the end that knowledge might be gained; he trained collaborators in geology and ethnology, giving them freely of his acute observations and profound generalizations, to the end that knowledge might be diffused; he would have it that the book should be a monument to his companions in the exploration, including those who faltered at the eleventh hour; and self is lost in the immortality of knowledge useful to mankind.

The publishers have done their part well. The print is large and clear and carefully proofread; the paper is good, and the illustrations are ample and well selected. Nearly all of the illustrations have been used before, either in governmental publications or in magazines, and to some readers this fact may convey a bad impression; but all of the illustrations have grown out of the work of the author. In some cases, too, it might have been desirable to connect the illustrations more closely with the text by legend or otherwise, and this was perhaps avoided only through desire to economize space. The cloth binding is good, and the binding in leather is excellent. W J MCGEE.

Petrology for Students. An introduction to the study of Rocks under the Microscope. By ALFRED HARKER. Published by Macmillan & Co., New York. 1895. Price, $2.00.

As the author states in the preface, this text-book is prepared especially for English students, nevertheless, it will be found very useful for those beginning the study of petrography in this country who wish a text-book written in English. No systematic account of the crystallographic and optical properties of minerals has been attempted, and for such information the student is referred to the translation of Professor Rosenbusch's volume on the rock-making minerals. But as an introduction to the study of the rocks themselves a number of useful observations of a general nature are presented upon the characters of minerals in this section, and especially the latest methods of distinguishing the different varieties of feldspar. In treating so complex a subject as the optical properties of minerals in thin sections in such a condensed manner it is doubtful whether the author can meet the wants of a beginner. It

serves, however, as a form of definition of the terms used throughout the book. It would seem that in neglecting the use of those methods of determination based on the optical phenomena observed with converging polarized light the author needlessly weakens the processes of petrographical diagnosis.

In his remarks upon the examination of rock sections the author shows his appreciation of the broad field of the science, which, as he says, is not merely an attempt to discover the composition of a rock, but to unravel its history as well. His clear understanding of the subject is also shown in his discussion of the classification of rocks, especially those of igneous origin. In the present chaotic condition of the nomenclature of rocks it will be difficult for any one who does not succeed in reforming the whole system to classify rocks to his own complete satisfaction or to the satisfaction of any one else. In his attempt at simplification Mr. Harker has shown his independence to a considerable extent, while following in the main the classification of igneous rocks adopted by Rosenbusch, though under a different terminology. Thus massive igneous rocks are subdivided into *plutonic*, *intrusive* and *volcanic*, corresponding to *tiefengesteine ganggesteine* and *vulcanischegesteine*. In many other ways also the author follows the methods and principles of Rosenbusch. Under each of the three great divisions above named the rocks are arranged according to their mineralogical or chemical composition, beginning with the most acid. The names used for varieties of rocks within different families are generally those expressing the mineralogical characteristics of the particular variety rather than those of a geographical character which may already be in common use. But in most cases both names are given. The most noticeable instance of this is in the peridotites.

In substituting the term *intrusive* for that of *ganggesteine*, and in maintaining an independent grouping for certain varieties of intrusive rocks, the author has not improved on the presentation of the case as made by Rosenbusch; and his remarks in introduction of his *intrusive* division are in the nature of an apology.

Nor does his use of the term acid intrusives, in distinction to that of porphyries and porphyrites, appear to be fortunate. Diabases are classed as intrusives. Under *volcanic* rocks no distinction is made between older and younger lavas, which certainly seems to be the only proper method of treatment. In this respect the classification follows the English usage. Fragmental products of volcanic action are described in connection with sedimentary rocks.

The descriptions of the various rocks embrace a general definition in mineralogical and structural terms, followed by an account of the constituent minerals and of the microstructure. Illustrative examples are chosen as far as possible from occurrences in Great Britain. The many references to the writings of British geologists and numerous others to the works of foreigners add greatly to the usefulness of the book for more advanced students.

The sedimentary rocks are divided into *arenaceous*, *argillaceous*, *calcareous* and *pyroclastic* kinds. Under the first division the general terms are defined and the characters of the derived grains and of the authigenous constituents are discussed separately. In this way the general characteristics of all arenaceous rocks are given rather than the specific character of any one kind of rock. In the chapter on argillaceous rocks the general definitions are first given, then the characters of the constituent minerals, followed by that of the structure. The description of illustrative occurrences serves to supply the need of some definite picture of different kinds of these rocks. The treatment of calcareous rocks is admirable for so condensed a statement. It deals first with the source and composition of these rocks; then the structure of organic fragments, followed by oölitic structure; the character of the matrix and of deep-sea calcareous deposits. Finally metasomatic changes are described and British examples cited. References to the literature of the subject are numerous and valuable. Pyroclastic rocks are briefly treated. Deposits due to chemical or to organic agencies are described in a few short paragraphs.

Under the head of Metamorphism the author discusses the general principles of the subject, and then describes the changes produced by thermal metamorphism upon the different kinds of sedimentary rocks, and upon igneous rocks

and the crystalline schists. This is followed by an account of the effects of dynamic metamorphism upon the minerals and structures of rocks. Very little space is devoted to the petrographical description of the various kinds of crystalline schists, which are grouped under the heads of *crystalline schists*, *gneisses*, *granulites* and *eclogites*. The basis of classification is structure. The book shows careful preparation, and although the reviewer has taken exception to some features of it he would recommend it to all those beginning the study of petrology.

JOSEPH P. IDDINGS.

SCIENTIFIC JOURNALS.

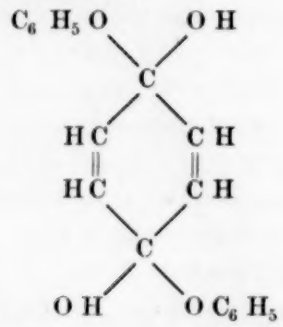
THE AMERICAN JOURNAL OF SCIENCE, NOVEMBER.

THE November number of the *American Journal of Science* opens with an article by A. De Forest Palmer, Jr., of Brown University, giving the results of measurements made at Baltimore in 1893 upon the D_3 helium line in the solar spectrum. The observations were made with a large telescope spectrometer with a plane speculum metal grating, the line in question being compared with the best standard lines in the field of view. Seventeen series of measurements were made, an equal number of observations being made on opposite points of the sun's limb to eliminate the effect of rotation. The average of the seventeen values obtained was $5875.939 \pm .006$. A paper by E. A. Hill discusses the new elements argon and helium with special reference to the question as to the atomicity of argon. It is argued that the observations thus far made are not conclusive as proving that it is monatomic; some suggestions are also made as to the relations between the elements named and other elements as shown in the periodic classification of Mendeléeff. Professor W. LeConte Stevens gives the remainder of his address delivered before Section B of the American Association upon 'Recent Progress in Optics;' the earlier part was published in the October number. Wells and Hurlburt describe a series of ammonium-cuprous double halogen salts. Other chemical articles are by Gooch and Evans upon the reduction of selenic acid by hydrochloric acid, and by Gooch and Scoville upon its reduction by potassium bromide in acid solution. L. V. Pirsson describes some phonolitic rocks from the neighborhood of the Bear Paw Mountain in Montana; one of these contained large crystals of pseudo-leucite, resembling those of Brazil and Magnet Cove, Arkansas. S. L. Penfield and J. H. Pratt give the results of an investigation of a series of minerals of the triphylite-lithiophilite group $(Fe, Mn)LiPO_4$, which show that the replacement of iron by manganese has a remarkable influence upon the optical properties. Two articles are given by O. C. Marsh, the first upon the Reptilia of Baptanodon Beds of the Rocky Mountain Jurassic; the second upon the restoration of some European Dinosaurs. Four plates accompany the latter paper, giving restoration of the genera: *Compsognathus*, *Scelidosaurus*, *Hypsilophodon*, *Iguanodon*. This paper was read before Section C of the British Association at the Ipswich meeting in September last. The concluding twenty pages of the number are devoted to abstracts, book notices, etc., in various departments of science.

AMERICAN CHEMICAL JOURNAL, OCTOBER.

THIS number of the Journal contains contributions from several laboratories and reviews of new books on chemistry. Two papers by White and Jones on the Sulphonphthaleïns contain results of work carried on in the laboratory of the Johns Hopkins University on this class of compounds. Four articles containing results of work in this line have already appeared. White prepared bromine and chlorine products of sulphonfluoresceïn, but found that the sulphonfluoresceïn itself could not be prepared by the action of resorcinol on orthosulphobenzoic acid, the product in this case containing four or six residues of resorcinol instead of two. Jones obtained similar results using the paramethylsulphonphthaleïn. Jackson and Grindley contribute the first of a series of papers upon the action of sodic alcoholates on chloranil. A number of substances were made belonging to a class which had not been very thoroughly investigated before and to which the authors give the name hemiacetals. The discovery of the hemiacetals of the quinones has led them to suggest a possible explanation of the constitution of quinhydrone and

related compounds. They would represent the structure of phenoquinone, for example, by the following formula, in which the phenol is added to the carbonyl groups:



A number of derivatives of this class were made and studied and various lines of research mapped out for the future.

A. S. Miller describes experiments made to determine the results of the action of ammonia on ferric and ferrous chloride. He found that the ferric chloride formed unstable compounds with ammonia, the product formed at ordinary temperatures being $Fe\ Cl_3.6\ NH_3$. At 100° this becomes $Fe\ Cl_3.4\ NH_3$ and dissociates when heated higher. The compound formed with ferrous chloride was $Fe\ Cl_2.6\ NH_3$. Mead and Kremers show that, when so-called 'nitrosopinene' is hydrolysed, carvacrol and not thymol is formed, and as the nitrosopinene is made from pinene we can pass from pinene to carvacrol. Wheeler contributes a preliminary paper on halogen addition products of the anilides. He has obtained bromine addition products of metanitroacetanilide which form substitution products by the loss of hydrobromic acid.

Noyes and Ellis have prepared diphenylbiphenyl synthetically by the action of sodium on brombiphenyl and shown it to be identical with the hydrocarbon benzerythrene, which is made from benzene by the action of heat. Reviews of several books are given, among them that of Cross and Bevan on Cellulose. A note on helium calls attention to its occurrence in many minerals and also in the free state, its properties, especially its low density and slight solubility, and the analogies in the spectra of helium and argon. J. Elliott Gilpin.

PSYCHE, NOVEMBER.

Mr. and Mrs. G. W. Peckham give an interesting account of the differences between two wasps of the genus Trypoxylon in their habits of making and storing nests. H. G. Dyar describes the larva of *Harrisina coracina* found on the vine in New Mexico; and A. P. Morse describes the colors of *Enallagma pictum*, an agrionid, during life. There is also a review of the last part of Edwards' Butterflies of North America and a brief notice of the late Mr. Riley. A supplement contains descriptions of a new genus and several new species of New Mexican bees, with notes on their habits, and a notice of the early stages of *Doryphora lineolata*, both by T. D. A. Cockerell; and the description, with figure, of a new New Mexican Thamnotettix, by C. F. Baker.

NEW BOOKS.

The Scientific Foundations of Analytical Chemistry. Wilhelm Ostwald. Translated by George M'Gowan. London and New York, Macmillan & Co. 1895. Pp. ix+207. $1.60.

Dynamics. P. G. Tait. London. Adam and Charles Black. New York, Macmillan & Co. 1895. Pp. xii+361. $2.50.

The Structure of Man. By R. Wiedersheim. Translated by H. and M. Bernard. London and New York, Macmillan & Co. 1895. Pp. x+227. $2.60.

An Introduction to the Study of Seaweeds. London and New York, Macmillan & Co. 1895. Pp. xvi+271. $1.75.

Handbook of Grasses. William Hutchinson, London, Swan Sonnenschein & Co. New York, Macmillan & Co. 1895. Pp. 92. 75 cents.

Elements of Plant Anatomy. Emily L. Gregory. Boston and London, Ginn & Co. Pp. viii+148.

Iowa Geological Survey, Vol. IV. Third Annual Report, 1894. Des Moines, published for the Iowa Geological Survey. Pp. 461.

On the Densities of Oxygen and Hydrogen and on the Ratio of their Atomic Weights. Edward W. Morley. Washington, The Smithsonian Institution. 1895. 4° pp. xii.+117.

Determinaçao das Posicões Geographicas. Pp. 57. *O clima do Rio de Janeiro.* Pp. 71. *Eclipses du soleil et occultations.* Pp. 54. L. Cruls. Rio de Janeiro, H. Lombaerts & C. 1894.